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PREVENTION AND TREATMENT OF CARCINOMA OF THE VULVA*

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CARCINOMA of the vulva is one of the rarer gynecologic lesions. Like carcinoma elsewhere, successful treatment depends very largely upon early diagnosis. An even more important factor is the recognition and treatment of conditions which predispose to the disease.

This study does not deal with a large series of cases and therefore is not statistically important, but it may emphasize certain significant correlations which our experience has suggested. The disease is an uncommon one; it falls into an age group in which life expectancy in general is not long; it is our belief, therefore, that the problem is such as to call for some latitude in the application of the usual standards set up for cancer therapy.

Symptoms and Prevention

This aspect of the disease cannot be too frequently stressed, for vulvar conditions which are related to the development of cancer are seen with some frequency. Any irritated or ulcerated lesion which does not yield within a very short time to simple therapy should be subjected to biopsy by free excision. Every leucoplakic area which causes constant itching, necessitating scratching for its relief—with consequent breaking or fissuring—should be excised. This excision may have to include all the vulvar structures. Ointments, hormones, and x-ray therapy have no place in such cases. The direct relationship between leucoplakia of the vulva and cancer has been amply demonstrated by Taussig[3] and others.[6, 18]

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The average age of our patients with vulvar cancer was 59 years when they were first seen. This is in close accord with that reported in other studies.[4, 7] It is, in general, a disease of advanced years. In the series of thirty cases which we studied, there were seven patients 70 years of age or over, and eleven patients 65 years or more. As with all cancer groups, there was a wide range in age, our youngest patient being 37 years of age. It is important, therefore, not to allow the general age incidence figures to influence us in the differential diagnosis of the individual case with a vulvar lesion.

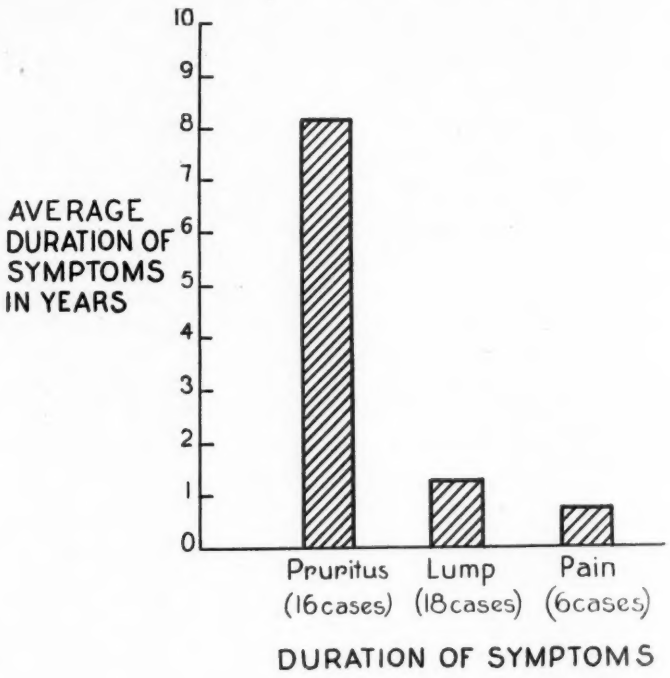

Fig. 1.

The remarkable delay between the onset of symptoms and treatment of the cancer is a phenomenon which everyone has noted in studying this disease.[1, 4, 7, 8] The average delay from the onset of vulvar symptoms to treatment of the cancer in our group was three and three-fourths years. Many of the patients had consulted a doctor much earlier, but he had minimized the condition. Vulvar lesions are not silent as a rule. Important symptoms in our series were pruritus in sixteen cases, a lump in eighteen cases, pain in six cases, and local discharge in two cases. It is interesting to examine the principal symptoms individually in respect to their duration before final treatment. The groups varied strikingly. Fig. 1 graphically illustrates the average duration of the principal symptoms before the cancer treatment. Pruritus was notably the longest with an average of 8.1 years; the symptom of a lump or local growth was present for an average of 1.25 years; the presence of pain was noted for an average of 0.69 years. It would seem probable that this variation is due to several factors: (a) the difference in unpleasantness of the symptom to the patient; (b)

the difference in correlation of these symptoms in the lay mind with publicized cancer threats; (c) the difference between the symptoms in their relation to the actual presence of carcinoma; pruritus may often be associated with leucoplakic lesions, while a lump and pain are more strikingly associated with the growth or ulceration of a well-defined tumor.

It would appear from these figures that this group of patients, like all other vulvar carcinoma groups, include many individuals who had lesions which should have brought them to surgical therapy much earlier. Pruritus is a particularly significant symptom in this regard, and its importance cannot be overstressed.

Treatment and Results

As we have stated previously, the number of our cases, thirty, is not large enough to make this study statistically important. They are presented because we believe from our limited experience that certain deviations from the generally accepted requirements for the surgical removal of a carcinoma are not only permissible but desirable in individual cases.

TABLE I. SURVIVAL AFTER TREATMENT

TOTAL GROUP OF CASES: 30		
TIME (YEARS)	NO. CASES	PERCENTAGE
2	17	56.6
3	15	50.0
5	11	36.6

TABLE II. SURVIVAL AFTER TREATMENT

TOTAL GROUP (INCLUDING ONLY CASES DEFINITELY PRIMARY ON VULVA): 25		
TIME (YEARS)	NO. CASES	PERCENTAGE
2	16	64.0
3	14	56.0
5	10	40.0

The total survivals in our group of cases are presented in Tables I and II. We are submitting the total results for all of our thirty cases, and also correcting these figures in Table II to exclude five cases which appeared in our hospital with a lesion, both in the vagina and on the vulva, of such a distribution that it was impossible to be certain whether or not the lesion was primary on the vulva. We are including two- and three-year survivals in our figures because all of our fatal cases dying with the disease did so before two years had elapsed from the time of treatment. The one patient who died with disease in three years was without doubt suffering from an entirely new and separate carcinoma. Our only other late local recurrence (three years) also appeared to have a new lesion in a leucoplakic area. This impression of early recurrence in cases where treatment fails and the separate identity of most so-called late recurrences is heightened by study of the cases reported in the literature.

Unfortunately, some of our cases have been treated in comparatively recent years. The dropping percentage in the tables represents for the most part this follow-up element rather than increased deaths.

The group of cases which we studied were treated by various methods, some of which have been little used in recent years, others of which are adaptable only to isolated cases with complicating factors.

Table III illustrates this variety of treatment which has been used:

TABLE III. TREATMENT

PRIMARY TREATMENT	NO. OF CASES	DEAD WITH DISEASE
Complete vulvectomy with bilateral groin dissection	5	1
Above surgery plus radiation	2	1
Complete vulvectomy with unilateral groin dissection	2	0
Above surgery plus radiation	1	0
Complete vulvectomy	2	0
Above surgery plus radiation	1	1
Partial vulvectomy with bilateral groin dissection	1	0
Above surgery plus radiation	0	0
Partial vulvectomy with unilateral groin dissection	0	0
Above surgery plus radiation	1	0
Partial vulvectomy	8	0
Above surgery plus radiation	3	1
Radiation only	4	4

It can be seen that all our treatment groups are small; appraisal of our plan of treatment is more readily obtained from a discussion of our failures than from our successes. An analysis of our fatal cases will be presented, therefore, at a later point.

The treatment employed is primarily surgical. Most of the cases in which radiation was added to the surgical treatment date back a number of years before treatment was well defined. The addition of radiation to one extensive case, which involved the vagina (see below) as well as the vulva, did not appear to add any benefit to the original complete vulvectomy and bilateral groin dissection, for the patient died within one year. Along with most other clinics we have discarded radiation as a primary treatment, except as a palliative. In four extensive cases in which both vagina and vulva were involved when first seen, radiation alone was used as a more or less palliative treatment. None of these survived longer than one and one-half years. We do have one rather unusual patient who came in with a similarly extensive lesion to that described above, and has survived for over five years. She was treated by partial vulvectomy, radium needles locally, and x-ray therapy. She is the only patient in our group with vaginal involvement who survived. Whether or not the interstitial radiation was responsible for this we cannot say.

We have subjected one group of patients to simple partial vulvectomy, and it is important to note that none of these patients died with the disease. It is our opinion that a simple wide excision of this type is the best biopsy method for vulvar lesions, if there is doubt concerning the character of the tumor. This will save a small group of cases—where the malignancy is low grade—from an unnecessarily radical operation. Therapeutically, this method was used in our series for basal cell lesions and other malignancies of very low grade; it was also used as a palliative procedure in several elderly patients with cardiovascular disease, rendering them bad operative risks. In our opinion wide local excision is an adequate treatment for basal cell lesions, and for squamous-cell lesions of

borderline or potential malignancy, like Bowen's disease.[12] Of course, the usefulness of this operation as a curative measure is limited by the small percentage of cases in which the malignancy is of this low grade character.

In the usual case with carcinoma of the vulva, we prefer complete vulvectomy with bilateral groin dissection. Our group of cases, like that of others, demonstrates the futility of attempting to diagnose involvement of inguinal nodes before operation, for the clinical impression was in error many times in both directions. We do not use the Basset operation.[17, 4, 5, 10, 11] Our technique is a one-stage operation which dissects the superficial inguinofemoral nodes bilaterally, and completely removes the vulvar structures. The groin dissections are done first with incisions paralleling the inferior borders of the inguinal

Fig. 2.—Carcinoma in region of clitoris with leucoplakia.

ligaments. Through this incision all the fatty tissue superficial to the inguinal ligament, including the nodes, can be removed; the remainder of the so-called inguinofemoral nodes, which are caudad to the lower border of the inguinal ligament in the superior portion of Scarpa's triangle and over the saphenous opening, are also removed. The external inguinal ring is then incised for several centimeters, and the fatty areolar tissue removed from the inferior portion of the inguinal canal. The internal ring is not incised, nor is the dissection carried to the lowermost portion of Scarpa's triangle; this latter region may be examined by palpation. The retroperitoneal and deep femoral nodes are not dissected.

When the groin dissections are completed, the inguinal incisions are joined by a transverse incision across the superior border of the mons veneris. This allows removal of the presymphyseal nodes and lymphatic channels. The block dissection is then continued with excision of all vulvar structures. All tissue is thus removed in one piece. Figs. 2 and 3 illustrate a typical lesion and the extent of the removal.

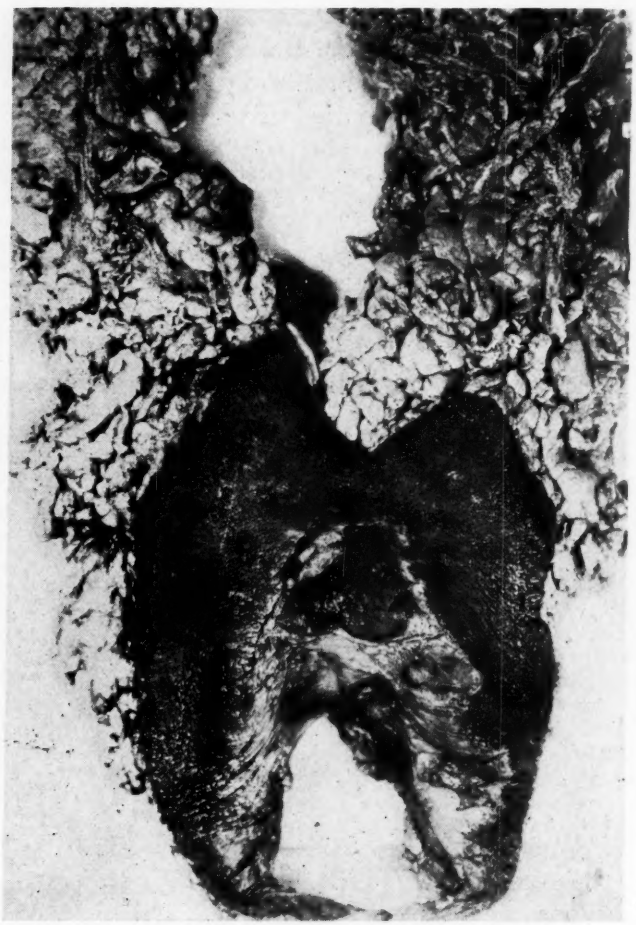

Fig. 3.—Tissue removed at operation in case illustrated in Fig. 2.

We do not find this one-stage operation ordinarily too shocking if a meticulous technique is rigorously followed, nor do we find wound breakdown a serious problem. While minor wound difficulties have occurred, major ones have been rare.

Study of reported dissections of retroperitoneal nodes does not indicate to us that external iliac and obturator nodes are frequently involved in operable cases.[3, 11] It has been our experience that the state of involvement of these retroperitoneal nodes frequently corresponds with extension of vulvar lesions locally into the vagina. When this occurs, all deep nodes of the pelvis are involved quickly: the hypogastric nodes, the ureteral nodes, and numerous channels in the paravaginal and parametrial tissue. Surgical removal of all this

tissue is a very extensive undertaking. More than one-third of our cases occurred in patients 65 years of age or over. In this age group Taussig's figures indicate a considerable operative mortality (18 per cent).[4] Since many of our less advanced cases died with cardiovascular or other intercurrent disease and not of cancer, it would appear that our conservatism at the time of operation is justified.

We do not dissect the deep femoral nodes (including Cloquet's node), an omission contrary to the technique of most operators.[4, 5, 11, 16] If operable cases have involvement of this group of nodes as constantly as indicated by some observers, the survival of any of our cases is unexplainable. It is possible that our results were favored by the anatomic distribution in our group. Of 26 cases where the primary site is accurately recorded, there were 19 in which it was situated on the anterior portions of labia, in the vestibule, or in the region of the clitoris. In the other seven cases the perineum, or posterior labial areas, were the sites originally involved.

We do not have a sufficient number of node dissections in our group to have statistically significant data concerning the curability of cases with node involvement. Of eight cases in which bilateral groin dissection was performed, negative nodes were found in four cases, both groins were positive in one case, and one of the groins was positive in three cases. Of the four patients who were subjected to unilateral groin dissection, the nodes were positive in two cases and negative in two cases. Of the six cases with gland metastases we have only two three-year survivals; two patients who survived have not been followed for three years as yet; the two early deaths include one patient who had intravaginal extension when operated upon, and one who died of a non-gynecologic disease.

An analysis of our fatal cases brings out some of the points which have been discussed. The data is presented in Table IV.

Examination of our first four fatal cases reveals the rapid course of the disease when it involves the vagina. It is sometimes impossible to be sure which is the primary site. Various degrees of radiation therapy failed to arrest the disease. Case 9 was a definite vulvar carcinoma which had extended into the vagina and, in spite of treatment which included complete vulvectomy, bilateral groin dissection, and radiation, she died with the disease in one year. It is evident that extension into the vagina makes the prognosis in vulvar cancer extremely grave.

Of the other patients who died with the disease Case 11 was an example of inadequate treatment. The groins were not dissected because this 70-year-old lady was a bad cardiac and poor operative risk. Case 6 was our only patient who died with the disease more than two years after treatment; the lesion from which she died was a new carcinoma rather than a recurrence, for it arose on the other side of the vulva in an entirely new and untreated region. This patient, because of her age, 77 years, was inadequately treated, being subjected only to partial vulvectomy. In three years a leucoplakic area on the opposite labium went on to malignancy—an argument for complete vulvectomy whenever feasible in all cases associated with leucoplakia.

TABLE IV. FATAL CASES

CASE NO.	SURVIVAL AFTER TREATMENT	SITE OF DISEASE	TREATMENT	CAUSE OF DEATH
1	6 months	Vulva and vagina ? Primary	X-ray	Died with disease
2	1½ years	Vulva and vagina ? Primary	Radium	Died with disease
3	11 months	Vulva and vagina ? Primary	Radium and x-ray	Died with disease
4	1½ years	Vulva and vagina ? Primary	X-ray	Died with disease
5	5 years	Vulva	Partial vulvectomy	Cerebral vascular accident
6	3 years	Vulva	Partial vulvectomy Radium	Died with disease; new lesion
7	24 days	Vulva	Complete vulvectomy; left groin dissection	Pulmonary embolus
8	1 year	Vulva	Complete vulvectomy; bilateral groin dissection	Died with disease
9	1 year	Vulva with extension into vagina	Complete vulvectomy; bilateral groin dissection and x-ray	Died with disease
10	7 years	Vulva	Complete vulvectomy; bilateral groin dissection and x-ray	Pernicious anemia; erysipelas; septicemia
11	1 year	Vulva	Complete vulvectomy; x-ray	Died with disease
12	1½ years	Vulva	Partial vulvectomy; bilateral groin dissection	Cardiac disease; diabetes uremia
13	9 years	Vulva	Partial vulvectomy	Carcinoma of cervix

We have seen but one patient with a lesion confined to the vulva and with complete operation performed who died of recurrence. This was Case 8, who was subjected to complete vulvectomy and bilateral groin dissection. The inguinofemoral nodes were negative on pathologic examination. She died with the disease in one year.

Summary and Conclusions

1. We have reaffirmed the singular importance of prophylaxis in carcinoma of the vulva. Temporizing measures are unjustified in the face of premonitory lesions, whose relation to cancer is evident. The symptom of vulvar pruritus in middle-aged women is a significant one.

2. We have discussed our plan of surgical treatment. We have found the operation of radical vulvectomy with bilateral dissection of the superficial inguinofemoral nodes an efficient one. The use of wide local excision as a biopsy method is proposed, and its therapeutic value in low grade malignancy suggested.

3. The gravity of prognosis with extension of disease into the vagina is notable in our cases. We cannot be as pessimistic as many observers, however, for the general group of vulvar carcinomas. Many of them can be cured.

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Discussion

DR. S. B. GUSBERG.—In our group of 30 cases, 24 were squamous cell, three basal cell, two melanomas, and one an adenocarcinoma arising from a sweat gland. During this same period our records show six cases of Bowen's disease of the vulva which were treated by excision.

We were attracted to study this small group of cases because of the fact that this carcinoma appeared to be one with a definite precursor which was seen with a fair degree of frequency, namely, leucoplakia of the vulva. This fact appeared to be definitely established in the literature, yet many of our patients were followed for a long time by their physicians and given an amazing array of treatments before they came to their ultimate definitive excision. It appeared to us, therefore, that the significance of vulvar lesions should be stressed, in spite of the fact that carcinoma was rather infrequent, because of the opportunity to remove tissue which might very definitely develop cancer.

DR. FRANK R. SMITH.—Before the war I had prepared a study of carcinoma of the vulva, not for the purpose of presenting any statistics, but with the idea of finding factors in the prognosis of this condition. At that time there were records of 119 patients with carcinoma of the vulva at Memorial Hospital. I was able to cull from the records 86 patients treated at Memorial Hospital up to the year 1936, so in 1941 we had five-year records of these patients. Of that group, our total five-year figure was only 28 per cent. After ten years the survival rate was 14.0 per cent, whereas after fifteen years, it was only 5 per cent. So that, of the patients who survived five years and seemed free of disease, at least 50 per cent of them were going to show a recurrence of the disease after ten years or nonsurvival.

The average age of our cases was 60 years, while Dr. Watson's was 59 years. Forty-one per cent of our group were in the decade from 60 to 70 years. There were 33 per cent of five-year survivals without disease in that particular age group. There were four patients between 25 and 35 years of age. All of the young patients that I have seen were women in whom the carcinoma was superimposed on a skin lesion, such as psoriasis, eczema, or lymphogranuloma. They responded to treatment, i.e., surgery, much more readily than the older patients.

As regards the type and location of the lesion, our results were not good where the lesion was situated around the clitoris. Strangely enough, 46.5 per cent of our patients had the lesion in the left vulva, whereas only 20.9 per cent had it in the right vulva. In about 16 per cent the lesion was around the clitoris. Those who had the lesion on the left vulva had the highest rate of five-year "cure," 32.5 per cent, as compared to 22.2 per cent and 21.4 per cent for the other two locations.

As regards the first symptom noticed, I have always considered leucoplakia and pruritus vulvae as the two cardinal primary ones. Yet in our group, over 31.3 per cent, or nearly

one-third of the patients, first noticed a lump in the vulva, whereas only 23 per cent in each case noticed ulceration or pruritus.

The patients who complained of pain were very few in number; the percentage in this group was 9.3. Pain was usually a later symptom, and the survival rate was not as good. The best survival rate, with regard to the first symptoms was in the group that first noticed a lump, where there was 37.6 for a five-year survival.

It is interesting that of our patients who had had symptoms for over two years, there were 27.9 per cent of five-year survivals. On the contrary, the group showing symptoms for less than six months had only a 9 per cent five-year survival record. This is evidence that the type of tumor rather than the speed of diagnosis and treatment may determine the results.

I was somewhat shocked when I found that only 51 per cent of our group, namely, 44 patients out of 86, came to us untreated from other places. Treatment had been begun either by surgery or radium. Yet our own results in the patients that we received untreated was only 29 per cent, whereas the total was 28 per cent. This would make one feel that other people haven't done much harm in their preliminary unsuccessful efforts.

With respect to the type of treatment, I thoroughly agree with Dr. Watson that the proper treatment is surgery. We have no patient treated with radiation alone who survived five years. We have a certain number of patients treated with irradiation to the groin nodes who survived five years, but they are in the minority. I think that treatment is dissection of the groins and vulvectomy.

The question of whether the complete operation should be done or not depends on several factors. We had not adopted the Basset one-stage procedure as a general procedure in 1936, when the last of these cases was being treated. It was a theory of Dr. Healy at Memorial Hospital that the lymph nodes of the groin should be used as a filter and vulvectomy done, allowing the lymph nodes to recede, if there was a lymphadenitis present, before the dissection was done, so we did not have the breaking down of the inguinal region after operation. That seemed to be the proper procedure. We had much better results with primary healing of the groins when we adopted that procedure.

I have been interested in the question of nationality in connection with carcinoma. Some time ago I studied that question in cancer of the cervix, and found that the Jewish population in the clinic, in general comprising 31 per cent of the total clinic, contributed less than 4 per cent of the cancers of the cervix. Similarly, Jewish women made up only 5 per cent of the cancer of the vulva group. In their prognosis they did very much better than the other groups. In their group four out of five survived for a period of five years, and this is our highest rate in a small number of cases.

Dr. Pollock has reviewed a larger series of Memorial Hospital cases, including my figures and those of the additional ten years through 1945, which will be presented by him.

DR. ROBERT S. POLLOCK (by invitation).—The following statistics are in the nature of a preliminary report. At the present time we are studying 244 cases of cancer of the vulva seen at Memorial Hospital from 1926 through 1945. These cases are being studied from the standpoint of symptomatology and location of the lesion in order to gather general knowledge about the process.

There are 162 recorded cases seen from 1926 through 1940 on which we are reporting five-year "cure" rates. Of this figure, 16 cases were deleted because they were not histologically proved, thus giving us a total of 146 cases. These have been divided into two groups: primary and secondary. The primary cases include those that have come to the hospital without any previous treatment of any kind. The secondary group includes those patients who have had some form of treatment, either at another institution or by an outside physician. This treatment would include x-ray, radium, or surgery.

We have 100 primary cases and 46 secondary cases. The "absolute cure" rate, that is, those cases without evidence of cancer five years after the first treatment, is 26.00 per cent for the primary group and 26.08 per cent for the secondary group.

The "determinate group" total is 132. This figure is arrived at after subtracting 14 cases from the 146 cases studied. These 14 cases represent eight who died of other causes and six who were lost track of at a time when they showed no evidence of cancer. There are 90 primary cases and 42 secondary cases in the determinate group, giving a determinate "cure" rate of 28.88 per cent for the primary, and 28.57 per cent for the secondary group.

There is one very interesting inference which may be drawn from the figures of our absolute "cure" rate. The percentages of both the primary and secondary groups are practically identical, and therefore it would seem that there are apparently two types of cancers of the vulva, one which can be cured despite loss of time and inadequate treatment, and another which is recalcitrant to treatment despite the application of all methods of therapy.

DR. MORTIMER D. SPEISER.—During the last ten years we have seen 29 cases of carcinoma of the vulva at Bellevue Hospital. Twenty-six of these were of the squamous-cell variety, and three adenocarcinomas. In the latter Group 2 originated from the Bartholin glands, and in one the origin was not definitely determined.

The primary cases of carcinoma of the vulva numbered 24; of these 10 were inoperable, and 14 were amenable to some type of surgical therapy. The treatment varied. Many cases were subjected to a radical vulvectomy with dissection of the inguinal nodes, while in other cases a radical vulvectomy was followed at a later date, after a week or two, by extensive inguinal node resections employing the Basset technique. Fifty per cent of our cases operated upon either died or showed evidences of recurrences, while the other 50 per cent are alive and well. Further scrutiny of this latter group reveals the fact that only two of these cases have gone for more than five years without recurrences. One patient has now been well for four years, and there are four patients who have been observed for one year or less since their operation. From the standpoint of a five-year salvage rate, there were only two cases out of 24, an incidence of 8.3 per cent, which is very much lower than the results obtained by Dr. Watson. I believe that in our patients the disease is far more extensive at the time of admission to the hospital, and for that reason fully half of our patients were beyond the possibility of any operative intervention. In these cases there was considerable involvement of the vagina, perineum, and perirectal tissues. In those cases in which surgery was undertaken, I believe that the disease again was well advanced as the result of neglect on the part of the patient prior to visiting a doctor. We were, therefore, dealing with a group of patients in whom we expected poor results with any method of therapy. The same condition exists in our cases with carcinoma of the cervix.

DR. GEORGE G. WARD.—In looking up the vulva cancer cases at the Woman's Hospital, I found that in 28,855 gynecologic discharges in the past fifteen years, there were seventeen cases. Of the eleven ward patients four are alive and seven dead. Of the six private cases one is dead, three are alive, and we have lost track of two.

Of the seven living cases, one is living 15 years, one 11 years, one seven years, one five years, and three one year.

We used radium alone in the early cases, but have since abandoned it. Of the cases in which radium alone was used, four in all, one is alive after fifteen years, the others having succumbed. We used radium with vulvectomy in one case, and that patient is still living after eleven years.

There were five cases in which vulvectomy alone was done. In that group two patients were alive after one year, and the other three were dead after five years.

We now do the complete vulvectomy operation in every case and follow it with the Basset procedure. We do not do the two procedures in the same sitting. In doing the Basset procedure we follow Dr. Taussig's well worked-out technique, which is very extensive and which makes a point of getting Cloquet's gland underneath the inguinal ligament, at the femoral ring. There were seven cases in which we did vulvectomy and the Basset procedure, and of that group three are dead and the other four are living, two for one year, one for seven years, and one for eleven years.

In the entire series of 17 cases, four are living five years or over, an incidence of 23.5 per cent.

I found that with radium the patients suffered great pain and sloughing, so we abandoned it. We feel that in marked cases of leucoplakia or kraurosis, vulvectomy should be done as a prophylactic measure.

Taussig's work is outstanding and his results are most conclusive. In 1940 he presented a paper in which he reported the results in 155 cases, and stated that radium in his hands was also disappointing and that he had abandoned its use. With vulvectomy and the Basset procedure, he expects survival in three out of five cases for a period of five years, or 58.5 per cent, even though two of the five show lymph gland metastasis.

In 1941 a very exhaustive paper was presented by Beven of Stockholm, in which a very thorough statistical study was made of a series of 177 cases in which there was a five-year cure of 36.7 per cent. They used electrocoagulation for removal of the vulvar growth, and then teleradium afterward. If there were any glands present, they did a block dissection. Their postoperative mortality was 8.5 per cent.

I think that today everyone is in agreement that vulvectomy, the classical procedure, thoroughly done, gives the best chance for a five-year cure.

THE ASPIRATION OF STOMACH CONTENTS INTO THE LUNGS DURING OBSTETRIC ANESTHESIA*

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IN MOST texts on pulmonary complications, aspiration of stomach contents into the lungs during general anesthesia is considered under the heading of postanesthetic pneumonia. Aspiration of infected material is said to produce atelectasis, pneumonia, and lung abscess.

A survey of New York Lying-In Hospital records of patients that aspirated gastric contents during obstetric anesthesia revealed the following different diagnoses: suffocation, massive atelectasis, partial atelectasis, disc atelectasis, pulmonary infarct, aspiration pneumonia, bronchopneumonia, lobar pneumonia, virus pneumonia, atypical pneumonia, tuberculous pneumonia, pulmonary tuberculosis, fungus infection, pulmonary metastasis, drowned lung, cardiac failure, pulmonary edema, and paroxysmal tachycardia. Obviously, a better understanding of this condition is wanting.

Present Study

There have been sixty-six instances of aspiration of stomach contents into the lungs in 44,016 pregnancies at the Lying-In Hospital from 1932 to 1945. The incidence of this complication is 0.15 per cent.

An analysis of the cases is presented and followed by experimental work to clarify the pathology of aspiration, and thereby gain insight into its diagnosis, prevention, and treatment.

Analysis of Cases

The significant data in the 66 cases are summarized in Table I.

The incidence of prolonged labor was somewhat higher than that of the total clinic population, which is 10 per cent.

Obstetric Reactions

Slightly more than half of the cases had operative intervention requiring relatively longer administration and greater depth of anesthesia than those delivered spontaneously. A mixture of gas, oxygen, and ether was employed in all instances.

Aspiration

Aspiration was recorded as having definitely occurred in the delivery room in 68 per cent. In 32 per cent this complication went unrecognized until later. The character of the aspirated material in the 45 recorded cases was liquid in 40 and solid in five.

*Read at a meeting of the New York Obstetrical Society, Dec. 11, 1945.

TABLE I. ANALYSIS OF 66 CASES OF ASPIRATION

Prolonged labor,	30 hours or over		9	or 14%
Type of delivery,	Normal spontaneous		29	44%
	Cesarean section		14	21%
	Operative other		23	35%
Anesthesia,	Gas, oxygen, ether		66	100%
Aspiration,	Recorded at delivery		45	68%
	solid	5		
	liquid	40		
	Subsequently diagnosed		21	32%
	Obstructive reaction		5	8%
	suffocation	3		
	massive collapse	2		
	Asthmatic-like reaction		61	92%
Cyanosis,	Recorded		55	83%
Tachycardia,	Pulse over 110 per minute		66	100%
Dyspnea,	Respirations over 30 per minute		66	100%
Chest pathology,	Diffuse		15	23%
	Right only		51	77%
	Left only		0	0%
Morbidity,	Febrile	20		30%
	chest	8		
	pneumonia	6		
	abscess	2		
	other	12		
Chemotherapy,	Sulfonamides		14	21%
	Penicillin	3		5%
	Both	2		3%
Deaths,	Immediate	2		3%
	Later	0		0%

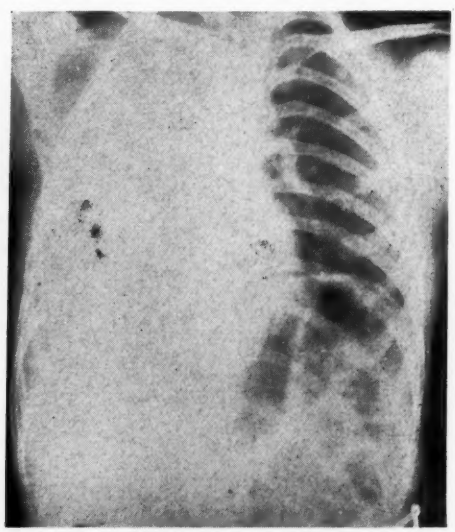


Fig. 1.—Massive collapse of right lung following obstruction by solid, undigested food. Note the mediastinal shift and homogeneous density over the collapsed area.

Obstructive reactions occurred in the five patients that aspirated solid material. Three of these had complete obstruction; two died of suffocation on the delivery table, whereas the third recovered after coughing up a large piece of meat. Two of the five patients had incomplete obstruction with massive atelectasis, and both recovered after coughing up the obstructing material. These patients exhibited the classical picture of massive collapse with cyanosis, tachycardia, dyspnea, evidence of mediastinal shift, and consolidation. Fig. 1 shows the typical chest plate in such a case. There is mediastinal shift and a homogeneous density over the collapsed area on the right side.

Asthmatic-like Reactions

A very different type of reaction was observed in the 40 patients that aspirated liquid material. For lack of any existing description, this type of reaction may best be likened to an acute asthmatic attack.

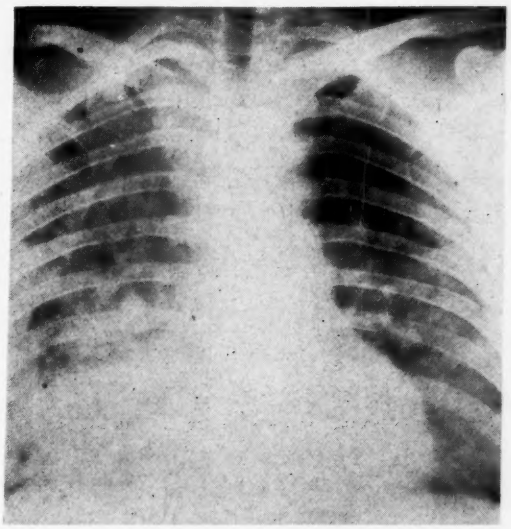


Fig. 2.—Scattered soft, mottled, confluent densities seen after aspiration of liquid gastric contents. Note the absence of any mediastinal shift.

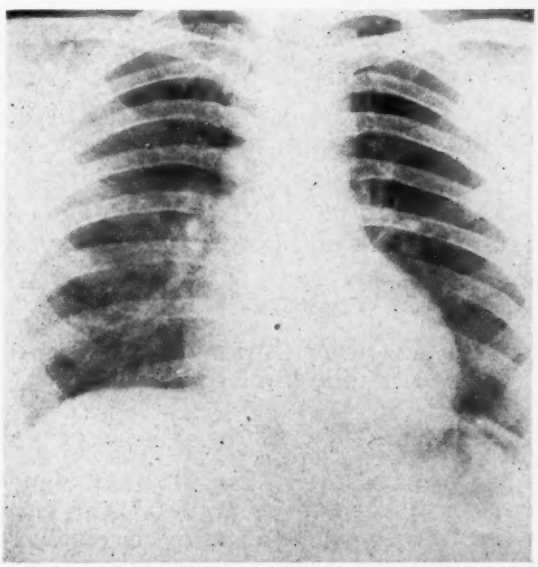


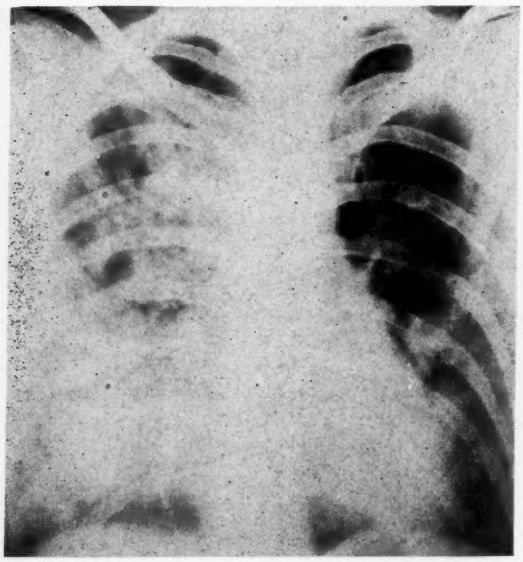
Fig. 3.—The same patient as in Fig. 2, ten days later.

Apparently liquid gastric contents were aspirated into the lungs, while the laryngeal reflexes were abolished during general anesthesia. The actual aspiration often escaped recognition. Cyanosis, tachycardia, and dyspnea developed as in the obstructive cases, but there was no massive atelectasis or mediastinal shift. Auscultation over the involved areas revealed numerous wheezes, râles,

and rhonchi. High pulse and respiratory rates were common, often reaching values of 160 and 40 respectively. Evidence of cardiac failure frequently appeared, and occasionally culminated in pulmonary edema.

The patients were critically ill during the acute episode, but there was gradual stabilization within twenty-four to thirty-six hours, and recovery was usually complete with an afebrile and uncomplicated course.

Early x-rays revealed irregular, soft, mottled densities in the involved areas, but no mediastinal shift. Subsequent films usually showed complete clearing within seven to ten days. These features are illustrated in Figs. 2, 3, 4, and 5.



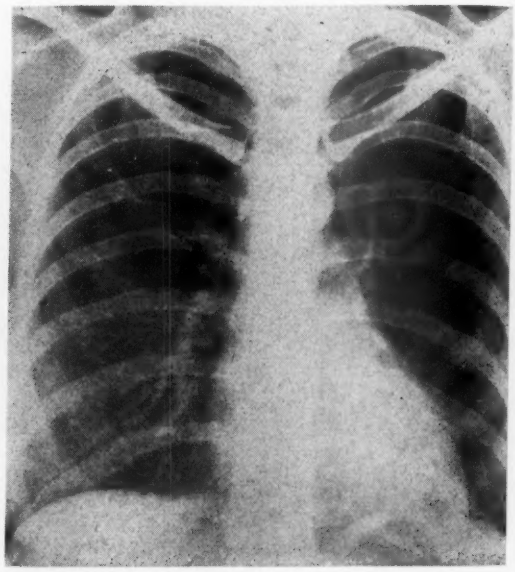


Fig. 4.—Another case after the aspiration of liquid gastric contents.
Fig. 5.—The same patient as in Fig. 4, seven days later.

Cyanosis, Tachycardia, Dyspnea

Cyanosis, tachycardia, and dyspnea occurred in most cases, regardless of the type of aspiration.

Chest Pathology

The right lung was most commonly involved in both types of aspiration. Massive aspiration, however, readily involved both lungs.

Morbidity and Chemotherapy

The morbid group includes any patient with elevation of oral temperature to 38° C. (100.4° F.) during any two twenty-four-hour periods postpartum, exclusive of the first twenty-four hours following delivery. Thirty per cent of all cases were morbid, but less than half the morbidity was attributable to chest pathology. Many cases occurred before the use of sulfonamides and penicillin, so that relatively few received this type of chemotherapy, yet only six patients developed pneumonia. Two of the pneumonia cases followed the obstructive type of reaction, and four followed the asthmatic type. One of each of these groups went on to develop a lung abscess. Fortunately all these patients recovered. Infection must be regarded as a relatively infrequent but serious secondary complication.

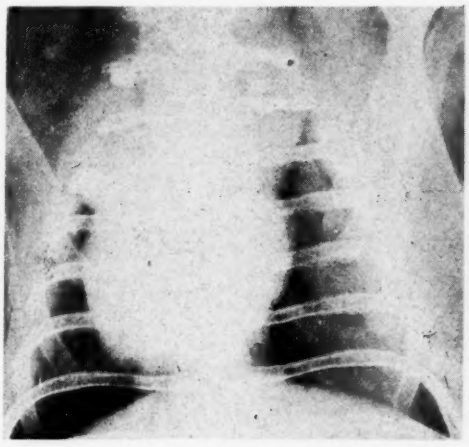
Mortality

The two deaths in the series were due to suffocation from complete obstruction by solid undigested food. Both patients had recently ingested a full meal; one eight hours previously, the other six hours previously. Autopsy obtained in the latter case revealed complete obstruction of the major respiratory passages by solid food particles.

None of the cases in the series suffered from pulmonary tuberculosis, primary organic heart disease, concurrent respiratory infection, or malignancy.

Experimental

A series of animal experiments were undertaken to determine the pathology of these two different aspiration syndromes. Anyone who has aspirated the slightest amount of fluid during a vomiting seizure will remember the intense irritation produced. It was thought pertinent to evaluate the role of hydrochloric acid.



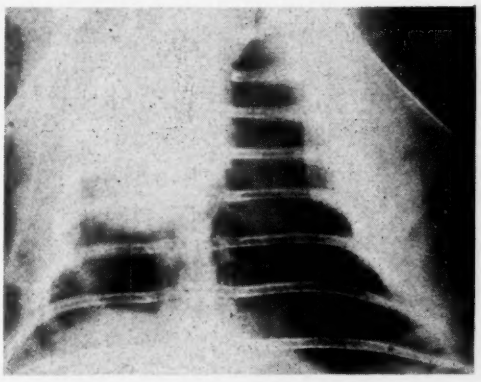


Fig. 6.—Chest film of normal rabbit.

Fig. 7.—Chest film of a rabbit after obstruction by solid undigested food. Note the mediastinal shift and homogeneous density over the collapsed area.

Various materials were introduced into the lungs of adult rabbits weighing between 5 and 6 kilograms. In some instances the material was introduced using a laryngoscope during sodium pentothal anesthesia, while in others the material was introduced directly into the trachea after preliminary tracheotomy.

The following substances were used: distilled water, normal saline, tenth normal hydrochloric acid, liquid vomitus, neutralized liquid vomitus, vomitus containing solid undigested food, and neutralized vomitus containing solid undigested food. All vomitus was obtained from parturient patients, none of whom suffered from achlorhydria. Such material was used in its acid state unless subsequently modified to a neutral pH, as previously indicated.

The experimental results may be summarized as follows. After aspiration of solid undigested food the picture is invariably that of obstruction as observed in the human. This is true regardless of whether acid or neutral material is used. Complete obstruction causes suffocation. Incomplete obstruction produces massive atelectasis. The chest film of a normal rabbit is shown in Fig. 6. Fig. 7 shows the picture with massive collapse following incomplete obstruction. Note the homogeneous density and mediastinal shift. Animals relieved of obstruction recover completely. The collapsed lung shows the typical

appearance of massive atelectasis. Practically all crepitation is gone, but otherwise the gross picture is not remarkable. There is no free fluid in the pleural or pericardial cavities. The heart and abdominal viscera are normal. The typical microscopic picture of atelectasis is seen in Fig. 8.

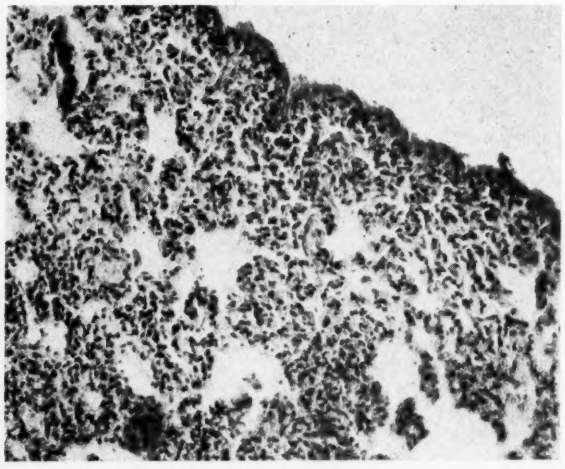


Fig. 8.—Section of a rabbit lung showing massive atelectasis.

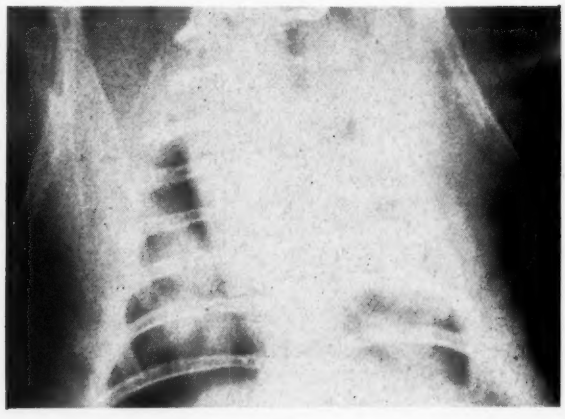


Fig. 9.—Chest film of a rabbit after aspiration of 20 c.c. of tenth normal hydrochloric acid. Note the soft, mottled, confluent densities and absence of any mediastinal shift.

Fig. 10.—Chest film of a rabbit after aspiration of 20 c.c. of unneutralized liquid gastric contents. Note the similarity to Fig. 9.

Following aspiration of liquid containing hydrochloric acid (tenth normal hydrochloric acid or unneutralized liquid vomitus) the animals develop a syndrome similar in many respects to that observed in the human following liquid aspiration. Cyanosis and labored respirations develop immediately, but death often ensues within minutes to hours, with a pink froth exuding from the respiratory passages in the terminal stages. X-rays reveal irregular, soft, mottled shadows without mediastinal shift. Fig. 9 shows the picture after aspiration of 20 c.c. of tenth normal hydrochloric acid, and Fig. 10 shows practically identical findings after aspiration of 20 c.c. of unneutralized liquid vomitus. The gross pathologic picture may be described as follows: The trachea is injected and filled with pink frothy material. The pleural cavities contain a

serosanguineous fluid. The visceral pleura is smooth with large subpleural hemorrhages, imparting a variegated color to the lungs, ranging from normal pink through all the shades of red to a rich dark purple. The darker areas are doughy in contrast to the pink areas which retain normal crepitation. The lungs are heavier than normal. Scatter emphysematous blebs are present. Fig.

Fig. 11.—Lungs of a rabbit after aspiration of 20 c.c. of tenth normal hydrochloric acid. The darker areas are hemorrhagic and doughy.

Fig. 12.—Lungs of a rabbit after aspiration of 20 c.c. of unneutralized liquid gastric contents. Note the similarity to Fig. 11.

11 shows the lungs after aspiration of 20 c.c. of tenth normal hydrochloric acid, and Fig. 12 shows a similar picture after aspiration of 20 c.c. of unneutralized liquid vomitus. On cut section the lungs exude a pink gelatinous material. The heart is dilated and shows small subpericardial hemorrhages. There is congestion of all the abdominal viscera.

Fig. 13.—Section of rabbit lungs after aspiration of 20 c.c. of tenth normal hydrochloric acid. Note the bronchiolar pattern with necrotic epithelium partly sloughed into the lumen, and the peribronchiolar congestion.

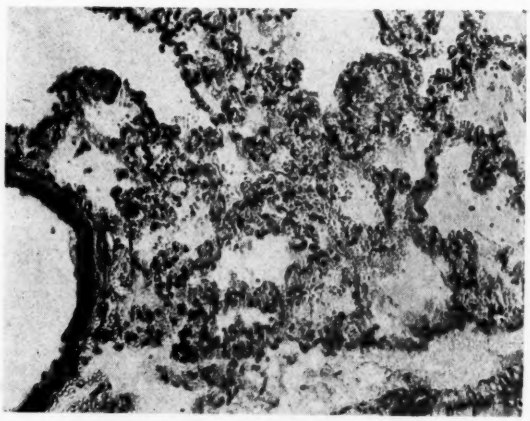
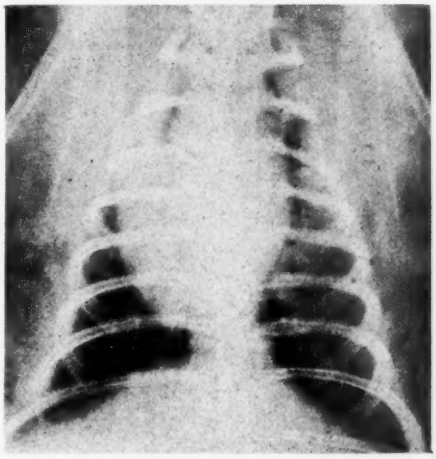


Fig. 14.—Section of rabbit lungs after aspiration of 20 c.c. of unneutralized liquid gastric contents. Note the character of the alveolar walls with pyknotic nuclei and the exudate within the alveoli.

The microscopic picture is also the same after aspiration of equal amounts of tenth normal hydrochloric acid or unneutralized liquid vomitus. The trachea and larger bronchi are congested, but the epithelium is intact. A wavy bronchiolar pattern is noted, indicative of muscular spasm. There is peribronchiolar hemorrhage and exudate with areas of surrounding emphysema. In places the bronchiolar epithelium is necrotic and sloughed into the lumen. The alveolar walls are hyaline with absent or pyknotic nuclei. Perivascular edema is marked. There is congestion and edema throughout. Figs. 13 and 14 demonstrate the above features.

Following aspiration of neutral liquid (distilled water, normal saline, or neutralized liquid vomitus) in equal quantities to the preceding series of acid experiments, the animals go through a brief phase of labored respirations and cyanosis, but within a few hours they are apparently back to normal, able to carry on rabbit activities uninhibited. There are no significant x-ray changes. Fig. 15 shows the chest film after aspiration of 20 c.c. of normal saline and Fig.



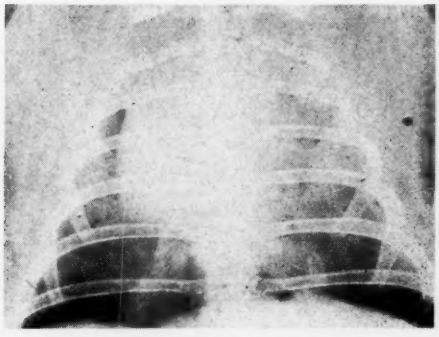


Fig. 15.—Chest film of a rabbit after aspiration of 20 c.c. of normal saline. There are no significant changes.

Fig. 16.—Chest film of a rabbit after aspiration of 20 c.c. of neutralized liquid gastric contents. There are no significant changes.

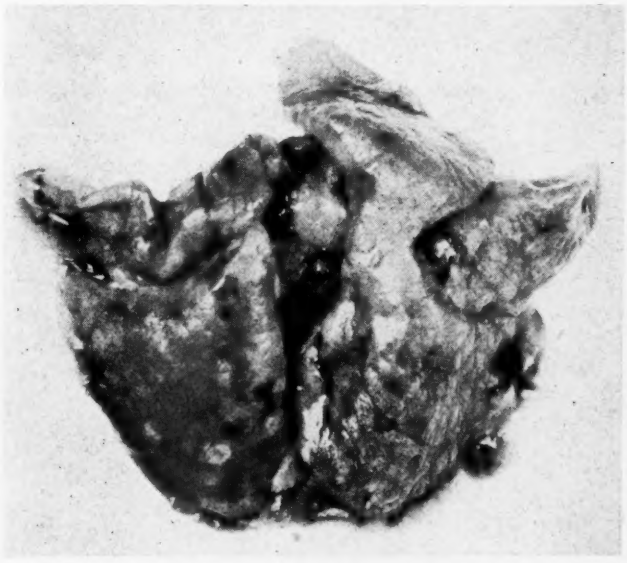


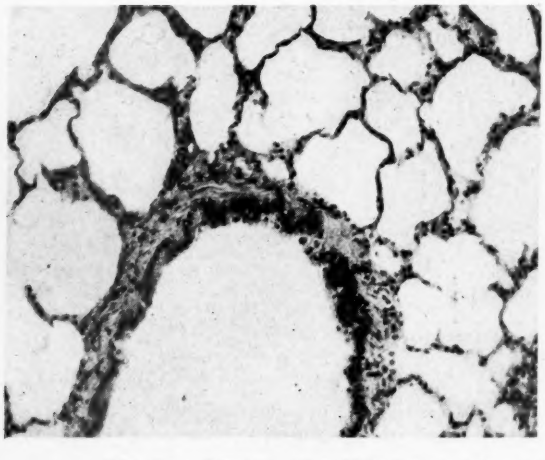
Fig. 17.—Lungs of a rabbit after aspiration of 20 c.c. of normal saline. Except for minute hemorrhagic areas, the lungs are not remarkable.

16 shows the film after aspiration of 20 c.c. of neutralized liquid vomitus. The gross pathologic changes are minimal. The trachea and larger bronchi are normal. There is no free fluid in the pleural or pericardial cavities. The lungs show minute scattered areas of atelectasis, but for the most part are crepitant throughout. Fig. 17 shows the lungs after aspiration of 20 c.c. of normal saline,

and Fig. 18 shows the lungs after aspiration of 20 c.c. of neutralized liquid vomitus. The cut surface of the lungs is normal. The heart and abdominal viscera are unremarkable.

The microscopic picture is not remarkable except for small patches of atelectasis and emphysema. There are no bronchiolar changes. Hemorrhage, congestion, edema, and exudate are absent. Fig. 19 shows a section from the lungs after aspiration of 20 c.c. of normal saline, and Fig. 20 shows a section following aspiration of 20 c.c. of neutralized liquid vomitus.

Fig. 18.—Lungs of a rabbit after aspiration of 20 c.c. of neutralized liquid gastric contents. Essentially the same as Fig. 17.



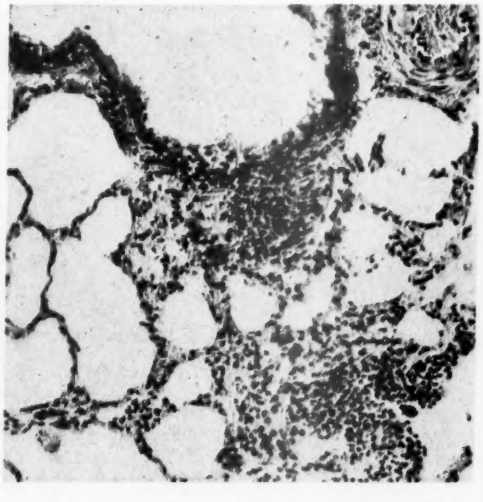


Fig. 19.—Section of rabbit lungs after aspiration of 20 c.c. of normal saline. There is slight emphysema, but otherwise the section is unremarkable.

Fig. 20.—Section of rabbit lungs after aspiration of 20 c.c. of neutralized liquid gastric contents. There is a small area of atelectasis.

Discussion

The gastric emptying time is often prolonged during labor. This applies to liquid as well as solid stomach contents. At delivery it is not uncommon for a patient to vomit food ingested twenty-four to forty-eight hours previously. As much as a liter of clear to dark green fluid has been recovered from a single patient.

Aspiration of vomitus may occur while the laryngeal reflexes are abolished during general anesthesia. Bronchial configuration favors right-sided aspiration, but massive aspiration readily involves both lung fields. Liquid material is more commonly aspirated than solid. The consistency and dimensions of solid food probably interfere with its aspiration.

This study reveals that two entirely different syndromes may follow aspiration. Aspiration of solid food usually produces the well-known picture of laryngeal or bronchial obstruction. Complete obstruction produces suffocation. Incomplete obstruction produces massive atelectasis with the classical picture of cyanosis, tachycardia, dyspnea, mediastinal shift, and signs of consolidation over the collapsed area. X-rays reveal a homogeneous density in the affected area and varying degrees of mediastinal shift. The pathology of atelectasis is well described in all textbooks dealing with the subject.

Obstruction should be promptly relieved either indirectly by external stimulation with encouragement of coughing, or directly with the aid of suction and endoscopic removal.

The value of sulfonamides and penicillin for this type of aspiration is questionable. Although the process is not primarily infectious, the seriousness of secondary pneumonia and lung abscess may make such chemotherapy worthwhile as a prophylactic measure.

Aspiration of liquid material produces an asthmatic-like syndrome with distinct clinical, roentgenologic, and pathologic features. Apparently this syndrome has escaped recognition, for to the author's knowledge it has not been previously described. There is cyanosis, tachycardia, and dyspnea, but no mediastinal shift or massive atelectasis. Wheezes, râles, and ronchi are heard over the affected portions of the lungs.

X-rays reveal irregular, soft, mottled densities without mediastinal shift. The picture has been misinterpreted as bronchopneumonia, tuberculosis, fungus infection, and even metastasis.

Progressive cardiac embarrassment and pulmonary edema may supervene, regardless of the previous normal condition of the heart. Here the diagnosis has been confused with primary cardiac failure.

The animal experiments indicate that hydrochloric acid is responsible for the changes described. The acid produces a bronchiolar spasm and a peribronchiolar congestive and exudative reaction interfering with normal intrapulmonary circulation to the extent that cardiac failure may develop.

The irritative action of hydrochloric acid on the respiratory tract has been previously studied by Winternitz,[1] specifically in reference to the action of chlorine and phosgene in war gas poisoning, but any relation to the pathology of aspiration appears to have been overlooked. The changes following aspira-

tion of tenth normal hydrochloric acid and unneutralized liquid gastric contents are similar to those following gassing with chlorine and phosgene, but there is less necrosis after aspiration, probably because of smaller concentration of the irritant.

Therapy in this type of aspiration should be directed against the bronchiolar spasm and cardiac embarrassment. Oxygen, atropine, adrenaline, and aminophylline will accomplish these objectives. Should evidence of cardiac failure develop, rapid intravenous digitalization is indicated. The circulatory burden may be further relieved by the application of tourniquets to the extremities to produce the effect of a bloodless phlebotomy.

The dramatic relief reported[2, 3] in the treatment of acute asthma by stellate ganglion block suggests that this procedure may be of value. The fundamental neurophysiology of stellate ganglion block is not clear, but the technique of performing the block is relatively simple. So far it has not been tried in the treatment of this type of aspiration.

The bronchoscope would appear to be of little value in this condition, for the pathologic process is beyond reach, and endoscopy may only increase the existent spasm and dangers of secondary infection.

The majority of patients have an afebrile recovery with complete clearing of the chest in seven to ten days. The pathologic process is primarily irritative and not infectious, but sulfonamides and penicillin may be of value in preventing secondary infection due to concurrent aspiration of nasopharyngeal flora.

It is conceivable that both solid and liquid aspiration may occur simultaneously, in which instance both the obstructive and asthmatic pictures would be found. In the present series this situation has not been encountered. Presumably the presence of any solid material so alters the consistency of the gastric contents that little material reaches the bronchioles.

It is important to appreciate that both types of aspiration are preventable. The delayed emptying time of the stomach during labor has already been discussed. The necessity of feeding the parturient has been overemphasized. Misinformed friends and relatives often urge the patient to ingest a heavy meal early in labor before going to the hospital. This food is supposed to provide strength for parturition. It is obviously dangerous to give any solid food during labor and it would be judicious to explain this to the patient during the prenatal course.

The dangers of fluid aspiration have been overlooked, for it is common hospital practice to urge water, tea, and fruit juices throughout the first stage of labor. It has already been pointed out that copious amounts of liquid may be retained in the stomach and that aspiration of liquid occurs much more frequently than aspiration of solid material.

It is common surgical practice to withhold all feeding for twelve hours or longer before any elective operation. This procedure plus the delayed emptying time of the stomach during labor probably account for aspiration being less of a surgical than an obstetric hazard. While it is true that the parturient expends considerably greater energy than the preoperative patient, it is unlikely that any serious harm would result from withholding all oral feeding for the

average duration of labor. Should fluid and caloric balance be disturbed in the event of prolonged labor, parenteral therapy is available.

Even if oral feedings were withheld during labor, it is possible that the stomach might still elaborate and retain sufficient hydrochloric acid to produce a serious aspiration hazard. This danger could be readily avoided by emptying the stomach prior to the administration of a general anesthesia. The time-honored finger in the throat method is always available, but the oral administration of a warm alkaline solution would in all probability produce the same desired effect and further obviate the dangers of residual hydrochloric acid being aspirated from the nasopharynx.

The anesthetic problem deserves special consideration. A new and inexperienced intern is frequently assigned to give obstetric anesthesia. Wider use of local anesthesia would eliminate the dangers of incompetently administered general anesthesia. Too often an active patient is rushed into the delivery room and a general anesthetic started with an opaque mask fastened over the face before information is obtained regarding the condition of the heart, lungs, or stomach. Examination of the heart and lungs is recorded on most labor sheets. The time of ingestion of the previous meal should also be recorded. This would draw attention to the possibility of a full stomach.

Once retching occurs, it is dangerous to force the anesthetic if the stomach has not been emptied. The mask should be removed, vomiting encouraged, and followed by thorough cleansing of the mouth and nasopharynx. Opaque masks are undesirable as vomitus may be concealed. It may also escape recognition if the anesthetist's attention is focused on the obstetric proceedings at the other end of the table. The anesthetist should remain with the patient until the laryngeal reflexes have returned.

Suction, laryngoscopic, and bronchoscopic equipment should be readily available in the delivery room, together with personnel trained in its use. The delivery table should be adjustable for Trendelenburg position.

Summary

Sixty-six cases of aspiration of stomach contents into the lungs during obstetric anesthesia are analyzed. The incidence of this complication is 0.15 per cent in 44,016 pregnancies at the New York Lying-In Hospital from 1932 to 1945.

Two distinct aspiration syndromes are described. The clinical, roentgenologic, and pathologic features of each are reproduced in the rabbit, and inferences drawn regarding diagnosis, prevention, and treatment.

Conclusions

1. Gastric retention of solid and liquid material is prolonged during labor.

2. Aspiration of vomitus into the lungs may occur while the laryngeal reflexes are abolished during general anesthesia.

3. Bronchial configuration favors right-sided aspiration. Massive aspiration, however, readily involves both lungs.

4. Liquid material is more frequently aspirated than solid.

5. Aspiration of solid material usually produces the classical picture of laryngeal or bronchial obstruction.

6. Aspiration of liquid produces an apparently hitherto unrecognized asthmatic-like syndrome with distinct clinical, roentgenologic, and pathologic features. This syndrome is due to the irritative action of gastric hydrochloric acid, which produces bronchiolar spasm and a peribronchiolar exudative and congestive reaction.

7. Aspiration of stomach contents into the lungs is preventable. The dangers of this complication as an obstetric hazard may be avoided by: (a) withholding oral feeding during labor and substituting parenteral administration where necessary; (b) wider use of local anesthesia where indicated and feasible; (c) alkalinization of, and emptying the stomach contents prior to the administration of a general anesthetic; (d) competent administration of general anesthesia with full appreciation of the dangers of aspiration during induction and recovery; (e) adequate delivery-room equipment, including transparent anesthetic masks, tiltable delivery table, suction, laryngoscope, and bronchoscope; and (f) differential diagnosis between the two syndromes described, and prompt institution of suitable therapy.

NOTE.—The factors used in the animal x-ray experiments were: 50 kilovolt peak, 36 inches, 3 seconds, 40 milliamperes, using a cassette and Bucky diaphragm.

The author wishes to thank the members of the Lying-In staff for permission to use the private cases included in this study. Acknowledgment of technical assistance in the animal x-ray work is expressed to Miss Mildred Powlitis.

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Discussion

DR. PALUEL J. FLAGG (by invitation).—I would like to present several observations. It seems to me that these accidents may be divided into the acute emergency, the asphyxial accident that occurs on the operating table, and the postasphyxial problem presented by the aftercare. It seems strange to me that there is no anesthetist on this program, as it largely is an anesthetic problem. It confirms an impression I have had for a long time, that we need a pneumatologic service in our hospitals, and that means a group who will care for the administration of gases, for the control of open anesthesia and, of course, we include local and basal anesthesia and other methods of general, as well as the use of gases for resuscitation, and the use of gases for inhalation throughout all the postasphyxial stage.

The pathology that has been described here seems to line up very closely with the pathology we meet with in anoxia. The studies as to the effect of hydrochloric acid are rather new, but the other phenomena that were described are quite usual in anoxic anoxia and obstructive asphyxia.

I desire to present a case which bears out the need of the triple service which I have referred to.

The operation was a cesarean section, done Jan. 9, 1940. No premedication. Gas-oxygen-ether anesthesia was used. Induction was smooth—relaxation early; pronounced salivation; high oxygen concentration maintained to the delivery of the infant, which was somewhat dusky in appearance, but breathed spontaneously.

As the uterus was being closed I noted that the patient's respiratory tidal volume was shallow, that the rate was up, and that it was difficult to oxygenate the blood with concentrated oxygen. There seemed to be some form of respiratory obstruction. Filling the bag with pure oxygen produced no effect on the patient's color. The obstruction was not the kind that produces cyanosis or labored breathing, but there seemed to be something interfering with the interchange of air. The patient was laryngoscoped, and I noted gastric contents in the pharynx and dark brown gastric contents escaping from the glottis. I intubated at once a No. 7 endotracheal tube and practiced endotracheal suction, the intubation taking place without any resistance. The glottis was open. Endotracheal suction resulted in the removal of a large quantity of gastric contents from the trachea and bronchi. Respiration improved and the color returned. The respiratory rate remained increased until the patient was returned to bed. Twenty-four hours after operation the patient developed a cough with expectoration, increased respirations, and pain in the chest. Examination of the sputum showed Type XVIII pneumococcus. She was put in a tent and given sulfonamides. In order to raise the tent oxygen concentration two tanks of oxygen were used simultaneously, so that we were using 25 to 30 liters of oxygen a minute. With this delivery a tent concentration of 50 to 60 per cent of oxygen was maintained. In other words, there is no point in giving oxygen unless you are getting a flow which is sufficiently high to reduce the asphyxiation. The respirations throughout were never labored, nor did they exceed 32 a minute. There was no bloody expectoration, and the color was satisfactory at all times. The use of the tent was discontinued on January 15, and the patient had recovered completely.

After the patient had been returned to bed there was pronounced aphonia, and she complained of distress on coughing. On entrance to the hospital the hemoglobin had been 60 per cent; it dropped to 47 per cent, and then returned to 60 per cent. An admission the red blood cells had been 3,800,000; they dropped to 2,900,000, and then returned to 3,800,000.

This case suggests the following comments:

The patient was properly prepared for operation, and yet there was enough fluid in the stomach to drown her. Mouth suction should always be at hand during obstetric anesthesia and, by being at hand, it should be turned on, and the suction tube should hang on the operating table where it can be reached and used instantly. It is not a question of merely having the apparatus; it should be on hand so it can be used if necessary.

Aspiration of stomach contents may take place without cough or struggle.

If a mask is strapped to the patient's face, preventing the escape or knowledge of gastric regurgitation, drowning may easily take place.

A laryngoscope should be at hand in every operating room and the anesthetist should be familiar with its use.

An oxygen tent is useless unless it contains the required oxygen. This should be constantly and accurately determined by the attending pneumatologist or pneumatologic technician.

DR. JAMES R. MILLER.—For the last eight years we have had in the Hartford Hospital a well-conducted "pneumatologic" service. During this time we have had 26,764 deliveries with 24 deaths, or 1 per 1115. We have had no asphyxial deaths, although several times a year we come near to it. The anesthetists are under the control of men who are skilled in the use of the laryngoscope, and suction, piped in the wall, is at hand.

There have been six deaths which occurred during or at the time of delivery or soon thereafter. One was in a cesarean section, a cerebral vascular accident; one was in a case of toxemia which should not have been operated upon, but would have died in either case; one was a spinal anesthesia death, in which the procedure was used under the protest of the anesthetist; one was a rupture of the uterus before admission; another was a severe toxemia; and one other was a rupture of the uterus, with possibly an associated aspiration, though no autopsy was done; and the last one died undelivered with a massive pulmonary embolism, proved at autopsy.

We feel very strongly the necessity of having a well-coordinated physician-controlled anesthesia department which is in control of all the pneumatologic and transfusion services.

THE MUSCLE OF MICTURITION

Its Role in the Sphincter Mechanism With Reference to Incontinence in the Female

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AFTER studying the urethra for a number of years, I concluded that, if progress was to be made in the treatment of its disorders, it is essential that a further study of its anatomy and physiology must be made. Therefore the gynecologist must acquire further facts and become more fully equipped if he is to render adequate assistance in cases of female incontinence. Here, I feel that a need really exists for a specialists' study of the anatomy of the mechanism so that one can clearly determine the facts.

To justify this paper, the author presents his method of further studying the anatomy of the urethra and some information which has come to light in this work, which will give us a more intelligent conception of the structure of this important organ. We must consider the physiology, and devote more time to find ways and means of restoring any partial loss of its function. It is desirable, therefore, to take an inventory of facts about the urethra, and then list the items which might be considered incomplete, obscure, or even not known.

1. Are the scattered striated intrinsic muscle fibers in the wall of the urethra separated or divided contracting units, or do they belong to one or more muscles?
2. Are these fibers the extensions of either the levator ani, the bulbocavernosus, the ischiocavernosus, or the transversus perinei muscles?
3. How are these muscle bundles innervated?
4. Where is the insertion of that portion of the levator ani which goes to the urethra?
5. Does the urethra possess peristalsis-like organs with similar muscular arrangement, as the intestine and the ureter?
6. Does the urethra pass the urine through it, other than by peristalsis?
7. What is the true sphincter?
8. How is it opened or closed?
9. What is the most probable mechanism of the sphincter?

It is quite clear that, if we are to answer these questions, we must know more anatomy at least, and, probably with it, more physiology.

Suppose we start with the intrinsic voluntary muscle fibers of the urethra and see what previous facts are available. Anatomists and histologists have for years observed striated voluntary muscles to be intimately connected in the urethral musculature. One author describes components of the urethra minutely, and intimates that the urethra consists of two coats of smooth muscle—an outer circular and an inner longitudinal—and that these coats are supported at certain intervals by a collection of striated and smooth muscles. He further

says that "certain striated muscle fibers belonging to the group of constrictors of the vestibule also surround and close upon the urethra." Anatomists speak of a voluntary or striated sphincter about the internal meatus, but they have not described any definite muscle. Others mention voluntary or striated fibers running over the urethra, but no fibers below it. One prominent gynecologist in the illustration of his book shows many voluntary fibers surrounding the urethra and many more passing over it to surround the vagina, yet had no definite beginning or ending. Little or no uniformity regarding these muscle fibers can be found, and their action is almost as obscure. Other anatomists believe them to be part of, and continuation of, the levator ani muscles, and if so, then they would constitute an insertion of this muscle. Some commentators would lead one to believe they might come either from the transversus perinei, the bulbocavernosus, or the ischiocavernosus muscles. No definite innervation to the intrinsic muscles has been observed. Until the anatomy is more clarified, the inventory questions remain unanswered.

I could see only one way to clarify this problem, namely, to make an anatomic, histologic study of the urethra in three dimensions. This was accomplished by serial sections of two urethras cut in planes at right angles, one at right angles to the canal, and the other at right angles to the sagittal section of the body, parallel to the canal. First, an adult urethra was obtained and serially sectioned at right angles to the canal. The sections were stained by the von Gieson method. Studying these sections revealed that many striated voluntary fibers passed transversely over the urethra (in the plane between the rami), then down into the lateral walls of the urethra to run posteriorly and obliquely between the longitudinal and circular smooth muscles, and then transversely under the urethra between the smooth muscles of the inner third of the urethra. Two small bundles of muscles jutted off these inferior transverse muscles, posteriorly and parallel to the canal to pass into the longitudinal smooth muscles of the trigone and end there. A full-term baby's urethra was treated similarly and gave similar information. The study was then carried on with one full-term baby's urethra cut at right angles to the canal, and a second parallel to the canal and at right angles to the sagittal section of the body.

Sections parallel to the canal and at right angles to the sagittal section of the urethra illustrate:

1. Two origins of the striated muscle. (Fig. 1.)
2. The nerve supply of the striated muscle. (Fig. 1.)
3. The striated muscle having its own identity separate from the levator ani, the bulbocavernosus, the ischiocavernosus, and the transversus perinei muscles. (Figs. 1 to 9.)
4. A most definite insertion of the levator ani ends in the lateral wall of the urethra not far from the junction of its middle and inner third. (Fig. 6.)
5. The extent of the glandular portion of the urethra (the outer third of the canal) and the relation of the bulbocavernosus muscle to this portion. (Fig. 1.)
6. The extent of the muscular portion of the urethra (the inner two-thirds), and the relation of the striated muscle to this portion. (Figs. 1, 2, 3, 7, 8, 9, 10.)

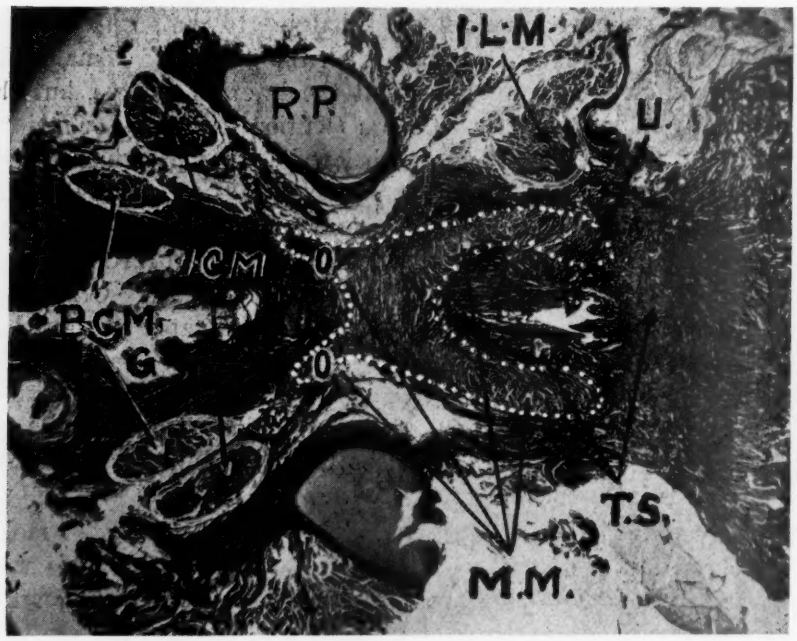

Fig. 1.—Section at right angles to the sagittal plane parallel to the urethral canal through the superior urethral wall.

M.M. = Muscle of micturition (striated). O.O. = Origin of the micturition (striated). B.C.M. = Bulbocavernosus muscle. I.C.M. = Ischiocavernosus muscle. G. = Glandular portion of urethra. I.L.M. = Insertion levator muscle. U. = Urethral canal. T.S. = True sphincter (involuntary, smooth)—circular and longitudinal muscle fibers surrounding the middle and inner two-thirds of the length of the urethra. P.N. = Pudendal nerve trunk. R.P. = Ramus of pubis.

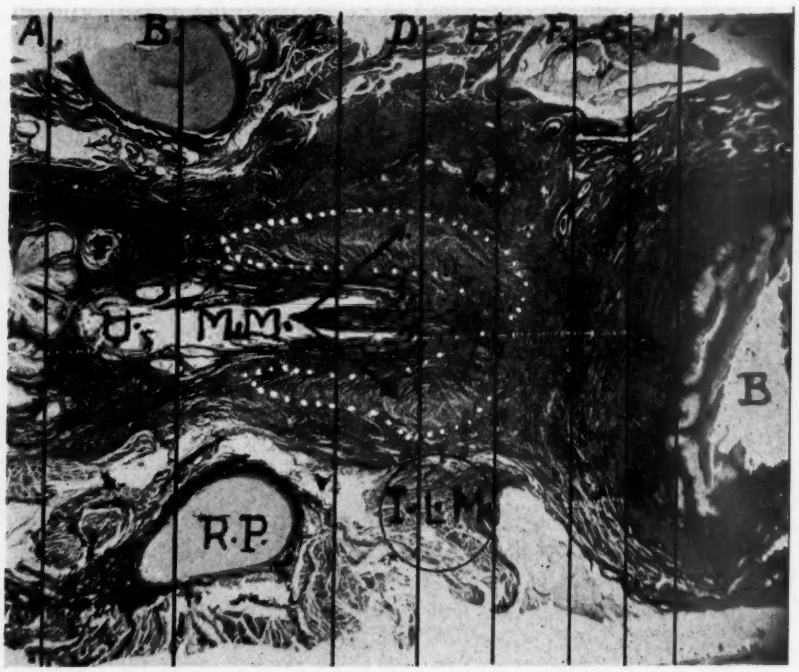

Fig. 2.—Section at right angles to the sagittal plane and parallel to the urethral canal through part of the urethral canal.

M.M. = Muscle of micturition (striated). B. = Bladder. U. = Urethral canal. I.L.M. = Insertion levator muscle. A.B.C.D.E.F.G.H. are lines through which corresponding following histologic sections have been taken. Sections are at right angles to the urethral canal.

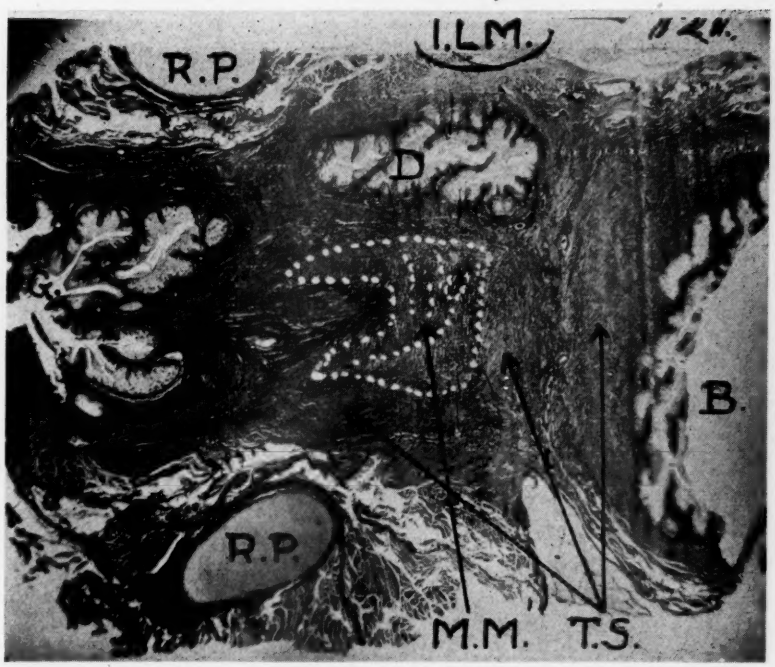

Fig. 3.—Section at right angles to the sagittal plane parallel to the urethral canal and through the inferior urethral wall.
M.M. = Muscle of micturition (striated); fibers run transversely and inferiorly. B. = Bladder. T.S. = True sphincter (involuntary, smooth)—circular and longitudinal muscle fibers surrounding the middle and inner two thirds of the length of the urethra. R.P. = Ramus of pubis. D = "Dimple"—vaginal mucosa. I.L.M. = Insertion of levator muscle. G. = Glandular portion of urethra.

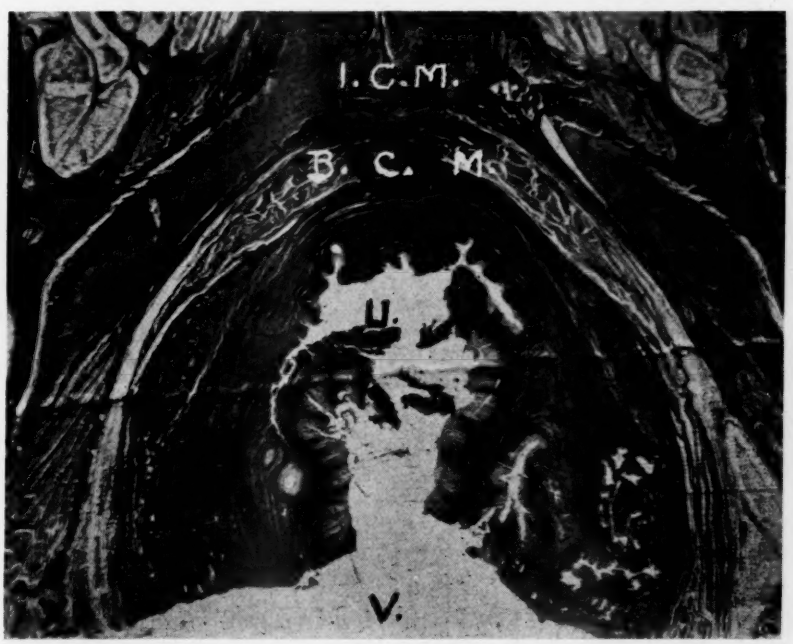

Fig. 4.—Section at right angles to the urethral canal at *A* in Fig. 2.
I.C.M. = Ischiocavernosus muscle. B.C.M. = Bulbocavernosus muscle. U. = Urethra glandular portion. V. = Vagina (fourchette).

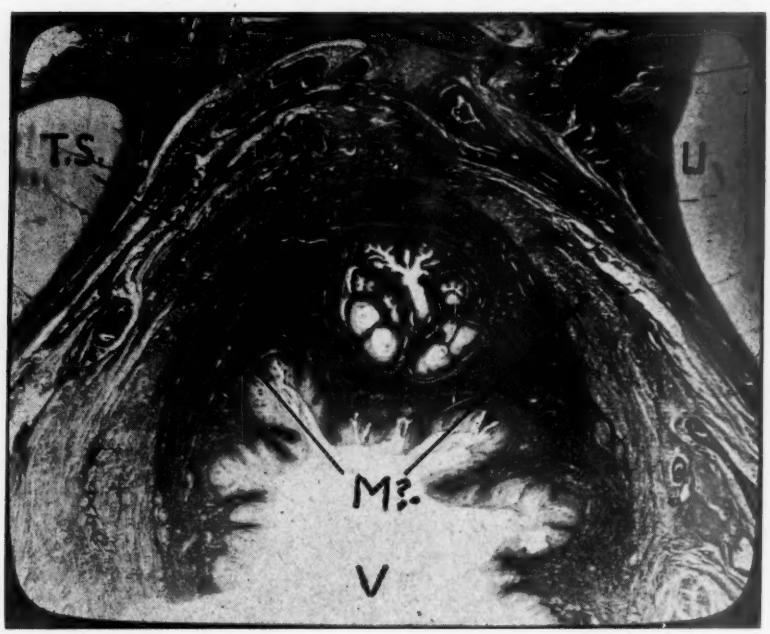

Fig. 5.—Section at right angles to the urethral canal at *B* in Fig. 2.
M.? = This muscle not yet identified but may be part of the bulbocavernosus. V. = Vagina. U. = Urethra (note that much of the glandular portion has been passed and we are entering the true canal). T.S. = True sphincter.

Fig. 6.—Section at right angles to the urethral canal, at *C* in Fig. 2.
M.M. = Muscle of micturition (striated). T.S. = True sphincter. U. = Urethral canal —only a few glands here. SY. = Symphysis. L.M. = Levator muscles. O.O. = Origins of levator muscles. I.I. = Insertions of levator muscles. V. = Vagina. D.D. = "Dimples"—vaginal mucosa.

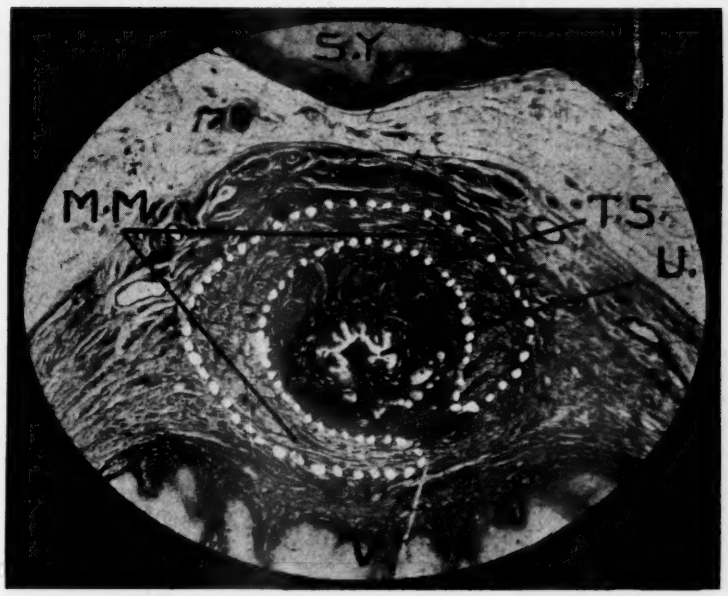

Fig. 7.—Section at right angles to the urethral canal at *D* in Fig. 2.
M.M. = Muscle of micturition (striated); more fibers in the superior wall. S.Y. = Symphysis. U. = Urethra. V. = Vagina. T.S. = True sphincter (smooth).

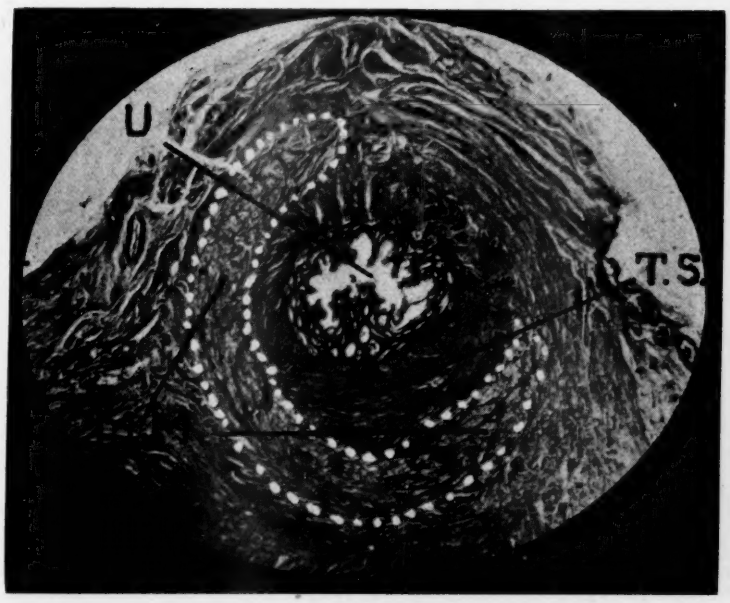

Fig. 8.—Section at right angles to the urethral canal at *E* in Fig. 2.
M.M. = Muscle of micturition (striated); more fibers in the inferior wall. U. = Urethral canal. T.S. = True sphincter (smooth).

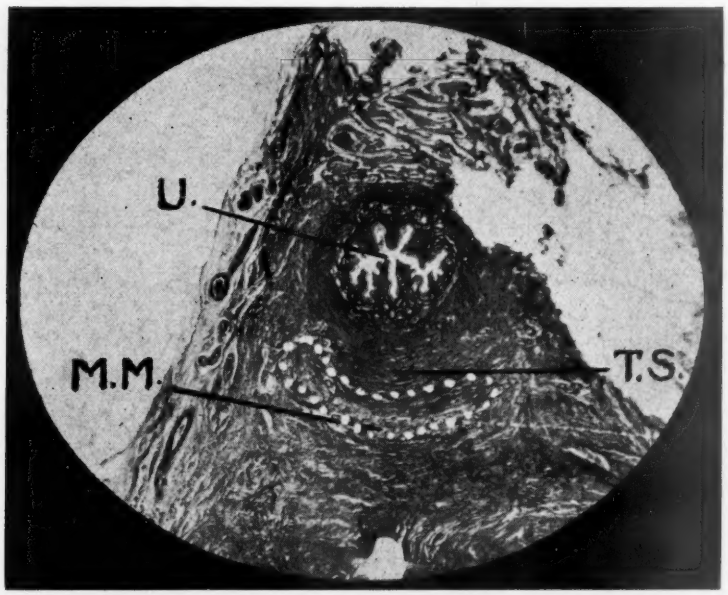

Fig. 9.—Section at right angles to the urethral canal at *F* in Fig. 2.
M.M. = Muscle of micturition (striated); all fibers in the inferior wall. U. = Urethral canal. T.S. = True sphincter (smooth); many circular fibers.

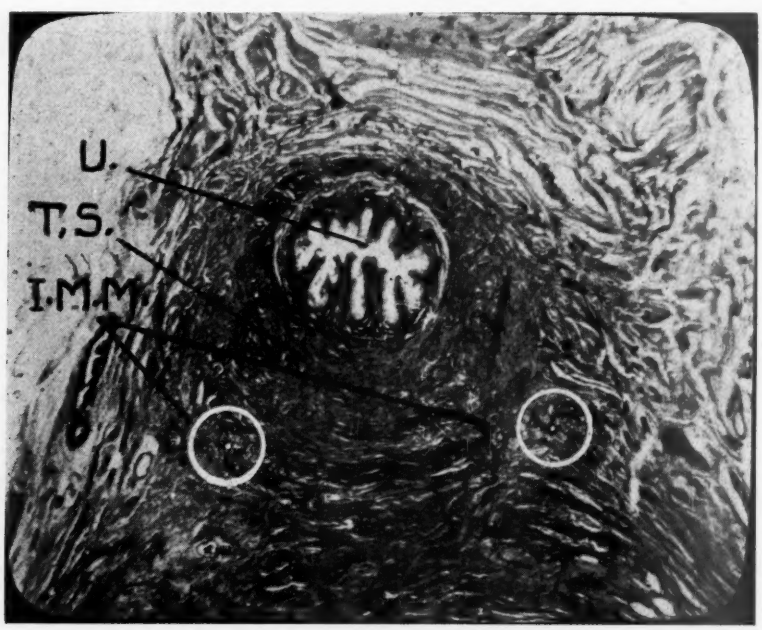

Fig. 10.—Section at right angles to the urethral canal at *G* in Fig. 2.
I.M.M. = Insertions of the muscle of micturition (striated)—interwoven with the longitudinal smooth muscle fibers in two small bundles. U. = Urethral canal—rather more undulated mucosa. T.S. = True sphincter—has here its greatest number of circular fibers.

7. The abundance of the circular smooth muscle in the bladder and urethral walls adjacent to the internal meatus. (Fig. 9.)

8. The abundance of autonomic ganglia which send neurones to the smooth muscle of the bladder and the urethra.

Sections at right angles to the urethral canal demonstrate:

1. Where the striated muscle runs in relation to the smooth muscles. (Figs. 1-10.)

2. Where the striated muscle has its insertions. (Figs. 9, 10.)

3. Where the levator muscle has its insertions. (Fig. 6.)

4. The very meager connection of the urethra to the symphysis. (Figs. 6, 7.)

5. The intimacy of the urethra to the anterior vaginal wall. (Figs. 6-9.)

6. The loose connection between the anterior vaginal wall and the trigone of the bladder. (Fig. 11.)

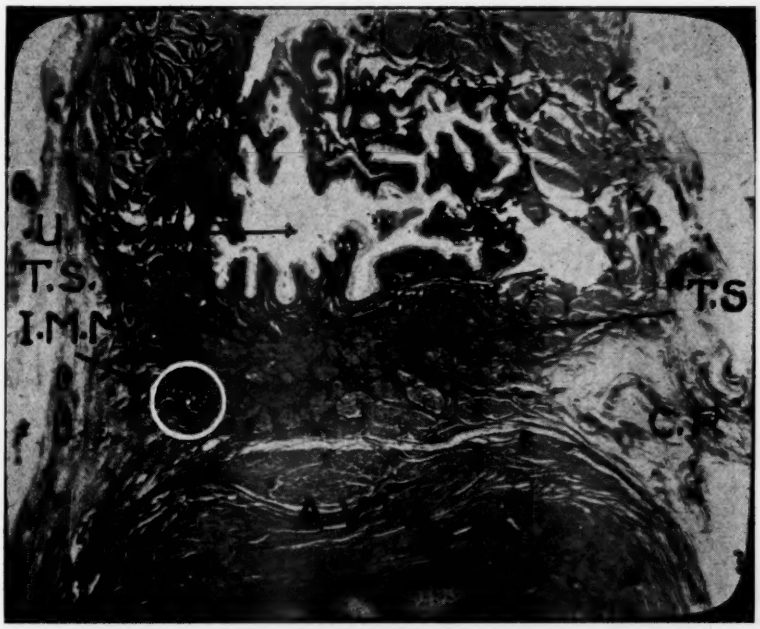

Fig. 11.—Section through the wall of the internal meatus of the urethra, at right angles to the canal at *H* in Fig. 2. The bladder is beginning here.
I.M.M. = The last bundle of the insertion of the muscle of micturition (striated). U. = The urethral canal opening into the bladder. T.S. = True sphincter (smooth) in the inferior wall of the urethra; it rests on the anterior vaginal wall. C.P. = Cleavage plane between the trigone and the anterior vaginal wall. A.V.W. = Anterior vaginal wall.

The muscle micturition is graphically illustrated in end and lateral elevations by line drawings in Fig. 12. When the true sphincter is circular and possesses sphincter control, the muscle of micturition is relaxed, oblique, and elliptical. When the true sphincter becomes oblique and is deprived of its sphincter control, the muscle of micturition is contracted and circular.

The True Sphincter

After assaying the muscles surrounding the urethra, the author has come to the conclusion that urine is held in the bladder *wholly* by the circular smooth muscle surrounding the inner two-thirds of the urethra, together with its as-

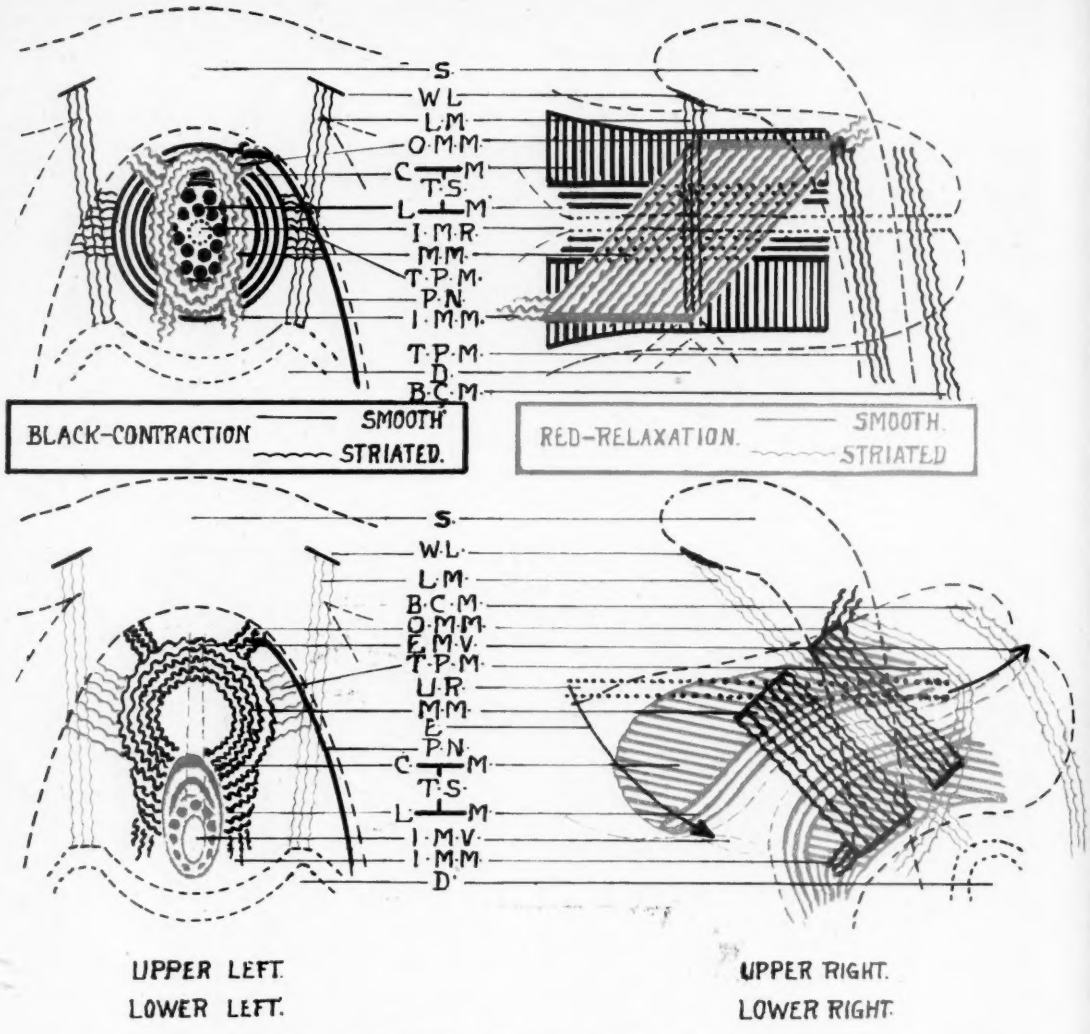

Fig. 12.—Graphic sketch showing muscles of the urethra. Muscles in black in contraction, muscles in red in relaxation, smooth muscles shown by smooth lines, and striated muscles shown by wavy lines.

Upper left—end elevation of the urethra when the muscle of micturition is relaxed. Upper right—lateral elevation of the urethra when the muscle of micturition is relaxed. Lower left—end elevation of the urethra when the muscle of micturition is contracted. Lower right—lateral elevation of the urethra when the muscle of micturition is contracted.

Upper left and upper right. S. = Symphysis. W.L. = White line. L.M. = Levator muscle (striated, contracted). O.M.M. = Origin of the muscle of micturition. T.S.C.M. = Circular muscle of the true sphincter (smooth, contracted). T.S.L.M. = Longitudinal muscle of the true sphincter (smooth, contracted). I.M.R. = Internal meatus of the urethra ("relaxing"). The external meatus appears at the opposite end. M.M. = Muscle of micturition (striated, relaxed). T.P.M. = Transversus perinei muscle (striated, contracted). P.N. = Pudendal nerve branch—innervates the muscle of micturition. I.M.M. = Insertion, muscle of micturition. D. = "Dimple." B.C.M. = Bulbocavernosus muscle (striated, contracted).

Lower left and lower right. S. = Symphysis. W.L. = White line. L.M. = Levator muscle (striated, relaxed). B.C.M. = Bulbocavernosus muscle (striated, relaxed). O.M.M. = Origin, of muscle of micturition. E.M.V. = External meatus urethra ("voiding"). T.P.M. = Transversus perinei muscle (striated, relaxed). U.R. = Position of the urethra when "relaxing." M.M. = Muscle of micturition (striated, contracted). E. = Excursion of the internal meatus of the urethra from its position "relaxing" to its position "voiding." A simultaneous excursion of the external meatus is shown by the arrow at the other end of the urethra. P.N. = Pudendal nerve. T.S.C.M. = Circular muscle of the true sphincter (smooth, relaxed). T.S.L.M. = Longitudinal muscle of the true sphincter (smooth, relaxed). I.M.V. = Internal meatus of the urethra ("voiding"). I.M.M. = Insertion, muscle of micturition. D. = "Dimple."

Muscles of the Urethra.

M.M.—Opponents { L.M., T.P.M., B.C.M. } Striated; { T.S.C.M., T.S.L.M. } Smooth.

Synonymous terms: "resting, in relaxation, in extension," describing the urethra in this paper are opposite to the synonymous terms; "voiding, in contraction, in flexion."

sociated longitudinal smooth muscle. I would like to refer to this portion of the urethra as a cylindrical sphincter. Its circular fibers are really circular when relaxed or in the "relaxing" state. The nerve supply is autonomic. The sacral and inferior mesenteric ganglia send neurones to the angle between the ureter and the bladder wall just before the ureter enters the bladder. Here ganglia are established which send neurones to supply the smooth muscle of the bladder and the urethra. Since this arrangement alone (without the muscle of micturition) is somewhat analogous to the intestine and the ureter, urine should be passed through the urethral canal by peristalsis. However, this would take an endless time and would be more or less constant, and Nature has made another provision in the muscle of micturition.

When the muscle of micturition (an oblique, purse-string, striated muscle) contracts, it changes from an oblique to a circular muscle, and, being a purse-string, it distorts the resting urethra, creating a new relation of its superior wall to its inferior wall. The inferior wall of the inner third slides forward to be directly beneath the middle third of the superior wall at the same time that the trigone slides under the superior wall of the inner third, and the circular smooth muscle which constitutes the true sphincter changes from a circular to an elliptical organ with the long axis in the sagittal plane. The sphincter is deprived of its control and permits urine to run out of the bladder. Thus, when the true sphincter is circular, the muscle of micturition is elliptical, continence prevails but, when the muscle of micturition is circular, the true sphincter is elliptical, incontinence prevails. Incontinence will be present in proportion to the amount of elliptical distortion of the true sphincter and will be permanent if the true sphincter is unable to return to its circular stage. Permanent peri-urethral adhesions, the relaxed or distorted true sphincter muscle, the contracted muscle of micturition and the cystocele, all contribute to permanent incontinence.

Studying both series of slides side by side, one gets the following picture of the striated muscle. Two origins can be seen, each loosely attached to the periosteum of the anterior medial face of the ramus of the pubis about the level of the superior part of the perimeter of the urethra in the plane of the rami. The muscles from these origins pass over the urethra transversely, and as they pass laterally they enter the wall of the urethra to pass obliquely and posteriorly as a "purse string" between the circular and longitudinal muscles and, when they reach the inferior wall of the inner third of the urethra, the greater number of fibers pass transversely. Two small bundles jut out posteriorly from these transverse fibers and find their way into and among the longitudinal muscles of the trigone and end there. These two muscle ends are the insertions. For simplicity I will refer to this muscle as the muscle of micturition.

Summing up, the muscle of micturition has two origins, passes completely and obliquely as a purse string in the muscle wall around the middle nad inner thirds of the urethra, and has two insertions into and among the smooth longitudinal muscles of the trigone.

The muscle, when relaxed, has the shape of an oblique cross section of a cylinder, but when it contracts it takes on the shape of a normal straight cross section of a cylinder. A nerve from each pudendal trunk seems to pass to the muscle of that side near its origin.

When the muscle of micturition relaxes:

1. The levator ani muscle contracts to lift the lateral wall of the urethra near the junction of the middle and inner third of the urethra, or the lateral wall of the cylindrical or true sphincter.
2. The bulbocavernosus muscle contracts to pull down the glandular portion and compress it.
3. The transversus perinei contracts to give firm support to the urethra at the junction of the outer and middle third of the urethra.
4. The cylindrical or true sphincter is circular in this "relaxing state," and possesses its greatest control.

No urine runs out of the bladder. In this state, the muscle of micturition (the oblique voluntary purse-string muscle) does not exert any distorting influence on the smooth muscle of the cylindrical sphincter.

When the muscle of micturition contracts:

1. The levator ani muscle relaxes and lets the muscle of micturition pull the lower wall of the inner third of the urethra down and out.
2. The transversus perinei muscle is pushed outward releasing any sphincter control, however small.
3. The bulbocavernosus muscle is pushed outward and up, and releases any sphincter control it may have had.
4. When the muscle of micturition, an oblique, purse-string, striated muscle, contracts it becomes circular to the urethra instead of oblique, and makes a new arrangement of the wall of the urethra. The inferior walls of the inner third of the urethra slide forward almost directly under the superior wall of the middle third of the urethra. None of the circular muscles which, in relaxation, was directly across the axis from its mate is any longer so, but is now diagonally across, the result being a distorted cylindrical sphincter. The cylindrical or true sphincter is now open and permits the urine to run out of the bladder. Any permanent degree of distortion means a similar degree of incontinence. In extreme contraction, all urine runs out of the bladder. At the same time the trigone is drawn toward the transversus inferior muscle of the muscle of micturition. This coincides with the "voiding state" spoken of in the author's previous articles. Again, adhesions may permanently cause some degree of this elliptical formation and therefore some degree of incontinence.

Conclusions

1. A serial section study of two planes at right angles of any organ of the body having obscure anatomy will yield valuable information.
2. There is need for an advanced anatomic text.
3. The levator ani muscle passes its insertion into the lateral wall of the urethra near the junction of the middle and inner thirds of the urethra.
4. The true sphincter of the urethra is *wholly* composed of the circular smooth muscle surrounding the middle and inner thirds of the urethra, together with their associated longitudinal smooth muscles. When relaxed it may be thought of as a *cylindrical sphincter*. In this "relaxing" state it prevents any urine escaping from the bladder.

5. A study of the urethra with serial sections, concentrating specifically on the intrinsic voluntary muscle fibers, reveals that they compose a single muscle, having an unusual shape and as unusual a function. It has been temporarily named the *muscle of micturition.*

6. The muscle of micturition has two origins, possesses its own identity, is entirely independent from and opponent to the levator ani, the bulbocavernosus, the transversus perinei, and the ischiocavernosus muscles, and has two insertions. Two nerves supply it, passing in near its origins, one branch each from the pudendal trunk ascending parallel to the ramus of the pubis. Its function, when contracting, is to distort and open the true or cylindrical sphincter.

7. When the muscle of micturition relaxes, the true or cylindrical sphincter exhibits its maximum control and no urine runs out of the bladder. When it contracts completely the cylindrical sphincter is distorted into an oval formation throughout its length. In this "voiding" state all the urine can escape from the bladder. If complete contraction becomes permanent, complete incontinence exists. Any permanent partial contraction will carry with it a corresponding degree of incontinence.

8. Should the muscle of micturition become devoid of innervation, the cylindrical sphincter would remain closed, and only peristalsis or bladder pressure would carry urine out of the bladder.

9. To obtain maximum restoration of continence it behooves the operator

a. To restore completely the relaxation of the muscle of micturition by putting the internal meatus of the urethra as far back in the pelvis as possible.

b. To restore as completely as possible the contracting power—at rest—of the levator ani, the transversus perinei, and the bulbocavernosus muscles.

c. To restore as much as possible all damage inflicted upon the trigone, the adjacent bladder wall, and the associated anterior vaginal wall, a procedure which is necessary for maximum efficiency of the cylindrical sphincter.

10. To achieve continence of urine it is necessary to maintain this restoration.

The author wishes to thank Dr. Albert H. Aldridge, Chief Surgeon of the Woman's Hospital for the privilege of carrying on this study, Dr. Leon Motyloff and Dr. Grete Stohr for their suggestions from time to time, and others who have in some way contributed to this work.

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TOTAL ABDOMINAL HYSTERECTOMY*

A Study of 500 Cases

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SINCE, in the development of abdominal surgery, hysterectomy first became practicable, there has been a continuous improvement in technique and in mortality. Subtotal hysterectomy was for a long time the standard abdominal procedure and, in many institutions, still is the most frequently performed operation. Vaginal hysterectomy a generation ago enjoyed a considerable popularity, and in the last fifteen years has regained a deserved consideration. In many of the more active clinics of the country, in those cases in which an abdominal operation is preferable, the total excision of the uterus has become more and more frequent. The removal of the cervix has definite advantages, whether it be accomplished by the vaginal or the abdominal pathway. While the proportion of women in whom cancer develops in the cervical stump which remains after a subtotal operation is small, the number of reported cases is large enough to merit attention. Even if we accept the incidence of 2 per cent, which has been given as indicating the probability of the appearance of cancer in the retained stump, the risk is worthy of notice. A second reason exists for the elimination of the cervix. Many cervices are unhealthy. Endocervicitis and eversion often indicate the presence of long-standing infection. Microscopic examination of excised cervices frequently, even in specimens which are definitely benign, shows evidence of epithelial activity which is not normal. Epidermidization and metaplasia are frequent evidences of an inflammatory stimulation of epithelial growth, and the obscuring of the normally clear-cut boundary between the portio epithelium and the cervical stroma indicates changes brought about by infection. These cervices which are not entirely normal are often troublesome after a subtotal operation. Discharge, which does not yield well to treatment, is often met with. The poorly nourished stump has a diminished resistance and does not respond as well to the usual forms of treatment as when the entire uterus is present. Bleeding is sometimes seen. The removal of the stump is sometimes indicated. For both of these reasons the elimination of the cervix seems desirable provided it may be accomplished without increase in the mortality rate, or, in any event, an increase not greater than the number of cases of stump cancer would account for. Fortunately, in well staffed clinics, this is entirely possible. I am not in agreement with an opinion recently expressed, that the total operation should be recommended for all operators. My purpose, in this communication, is to indicate what may be done by a group of trained men. The series here discussed was cared for by a small group of men, all of whom belong to the department of gynecology and obstetrics of Northwestern University.

*Presented before the 573rd regular meeting of the Chicago Gynecological Society, October 19, 1945.

It comprises a series of 500 cases done between the latter part of 1939 and August, 1945. It is interesting that, in the period considered, no case appears which was done by any member of the general surgical staff of our hospital. Only 6 were found done by approved members of a small courtesy group. These were discarded, although a good result was attained in all, in order to attain an accurate estimate of the work of the staff itself. During the period of time covered by this report, 316 subtotal hysterectomies were done and 353 vaginal hysterectomies. This makes a total of 1,169 hysterectomies of all sorts, in 73.8 per cent of which the uterus was completely removed.

The indication for operation in 319 cases was myoma. In many cases more than one indication existed, or, in addition to the principal indication, other conditions were found. Myoma was found together with ovarian cyst, inflammatory disease, more or less extensive, of the cervix, adenomyosis, postoperative adhesions, carcinoma of the corpus, and inflammatory residues. Adenomyosis as the principal indication was found in 52 cases. Functional bleeding called for treatment in 53 cases. In many of these the pathologic report indicated a uterus considerably over the normal size, with increased connective tissue and thickened blood vessel walls.

In 70 cases the condition of the cervix caused a note to be made in the record by either the pathologist or the operator. In arriving at this number, simple erosion of moderate degree was excluded and those cases in which the cervix was definitely unhealthy were counted. Among the cervical lesions were eight cases of stenosis in one of which a pyometra had been present. This had been relieved by dilatation and drainage some time before operation which was done to prevent inevitable recurrence of the obstruction.

Carcinoma of the corpus was found 27 times. Sarcoma of the uterus occurred once. Endometriosis appears as the primary indication for interference 35 times.

During the period under consideration technique has remained practically constant. With increasing experience the more extended operation was carried out with but little more effort than the subtotal one which had been the routine operation until a few years ago.

The frequent use of the total operation can be justified only if it can be done without increasing the mortality. If an increased mortality rate occurs, especially if it is sufficient to neutralize the incidence of carcinoma in the retained stump, the argument that it protects against cancer falls to the ground. In the series here reported there were two deaths, a mortality rate of 0.4 per cent. In another paper, in a series of 744 subtotal hysterectomies, we showed a mortality of 0.66 per cent. Obviously the danger is not increased under the conditions under which these operations were done. Without a thorough familiarity with pelvic anatomy and technique, there is a very definitely greater danger in the total operation. Among these particularly are injury to the urinary tract and hemorrhage.

Morbidity was estimated according to the rule of the American College of Surgeons, a rise of temperature to 100.4° F. on any two days, excluding the

first twenty-four hours, causes the case to be included in the morbid list. According to this standard, 141 patients, or 28.2 per cent, had a morbid recovery.

A standard as rigid as this, although entirely just, necessarily increases the percentage of morbidity. None the less, a widely used standard is of value as it enables comparisons to be made on a common basis. Many patients, who were in the morbid list, had a rise of temperature over 100.4° F. only two or three times and had very smooth convalescences. Serious morbidity was exceptional.

It should be recognized that, in vaginal and total abdominal hysterectomy, the vagina is opened. Careful preoperative preparation, which should always be done, cannot produce complete asepsis. In subtotal hysterectomy, if amputation is done below the level of the internal os an area which is bacteria laden is traversed. In all total hysterectomies, either from above or below, and in some subtotal operations, a nonsterile field is traversed.

Thrombophlebitis occurred three times, one of these patients being very sick. Recovery took place and the patient left the hospital on the sixty-fourth day. In the other two, convalescence was only moderately prolonged.

In one case total hysterectomy was done because of rupture of the uterus occurring in labor at term. A tear extended from the tip of the cervix to the left lower posterior part of the corpus. The tear was about five inches in length. The patient recovered.

In two cases ureteral injury occurred, in one case the ureter being tied while in the other it was cut. Both patients recovered, although nephrectomy was needed in both cases. The bladder was opened four times. Immediate suture was done and a permanent catheter put in. All of these recovered without trouble.

One of the deaths was caused by septicemia, a tracheobronchitis being also found at autopsy. The other death was from uremia with failure of urinary secretion. Cystoscopy and catheterization of the ureters proved the absence of ureteral obstruction.

In common with the majority of clinics today we believe in conservatism in dealing with the adnexa. In 239 cases the adnexa were not disturbed on either side, while in 136 more the ovary and tube, or at least the ovary, were left on one side. In 375 cases, therefore, both ovaries, or one ovary, remained. The advantage of this is too well understood to require elaboration. On the other hand an unhealthy ovary, or one of which, because of extensive resection, only a small part remains, is better removed entirely.

In 136 cases the appendix was recorded as having been removed; in 189 it was not removed; in 157 cases it had been removed previously; while in 18 cases the history failed to give clear information concerning the appendix. In one of the excised appendices a carcinoid was found. A conservative attitude toward the appendix seems wise. If the hysterectomy has been difficult, and no urgent reason appears for appendectomy, it may well be omitted. In only nine cases was any form of vaginal plastic work done. If any notable degree of lack of support of the uterus is found, we prefer to do vaginal hysterectomy unless a valid contraindication is present.

Technique, in most cases, is relatively simple. If the adnexa are to be preserved, two straight eight-inch clamps are placed close to the uterus on the broad and round ligaments and including the tube. The broad ligament is divided between these, and the outer clamps replaced by a figure-of-eight suture ligature. This is repeated on the opposite side. The uterovesical fold of peritoneum is opened and the bladder separated downward from the lower part of the uterus and the cervix. The uterine arteries are then isolated and tied.

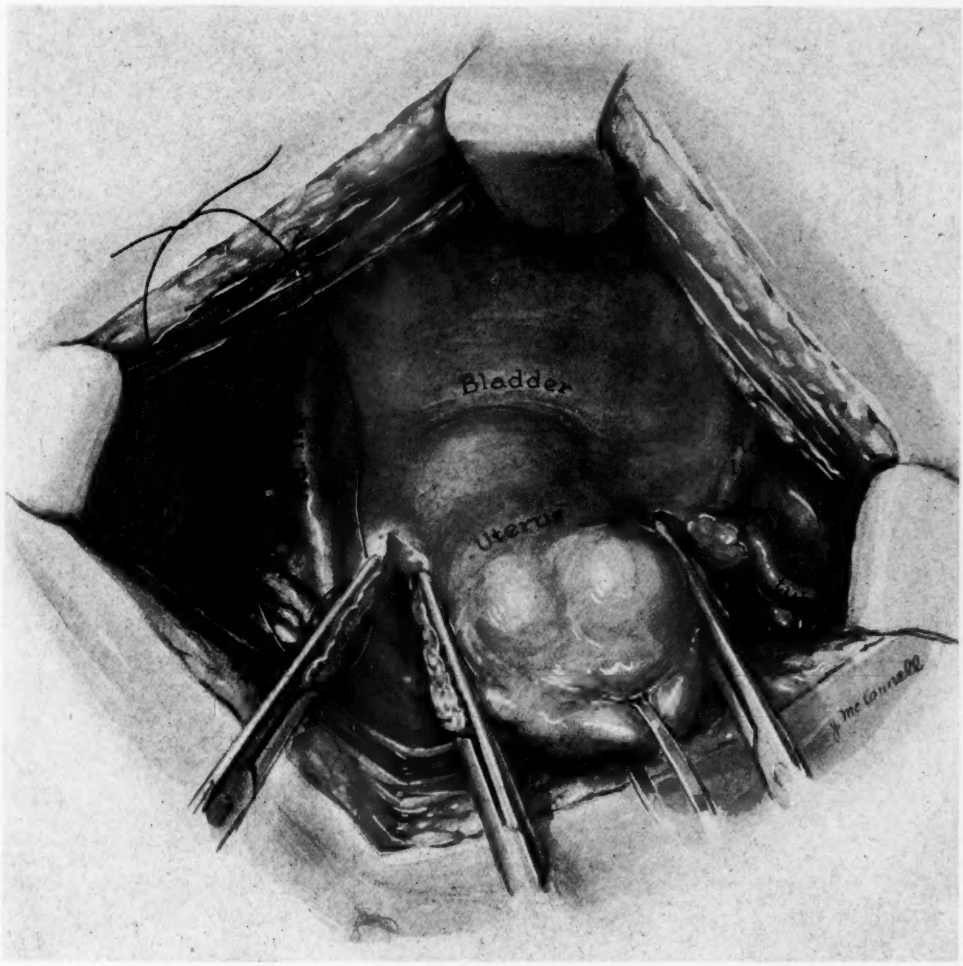

Fig. 1.

Another clamp is usually needed below the level of the uterine artery. All clamps are at once replaced by suture ligatures. The base of the broad ligament is then grasped by means of a short-jawed, moderately curved clamp which is ordinarily used for vaginal hysterectomy. This is replaced by a suture ligature. The vagina is then opened, cut around, and the uterus removed. If care is taken at this point to enter the vagina close to the cervix, and to divide the vaginal wall flush with the cervix, the vagina need not be shortened.

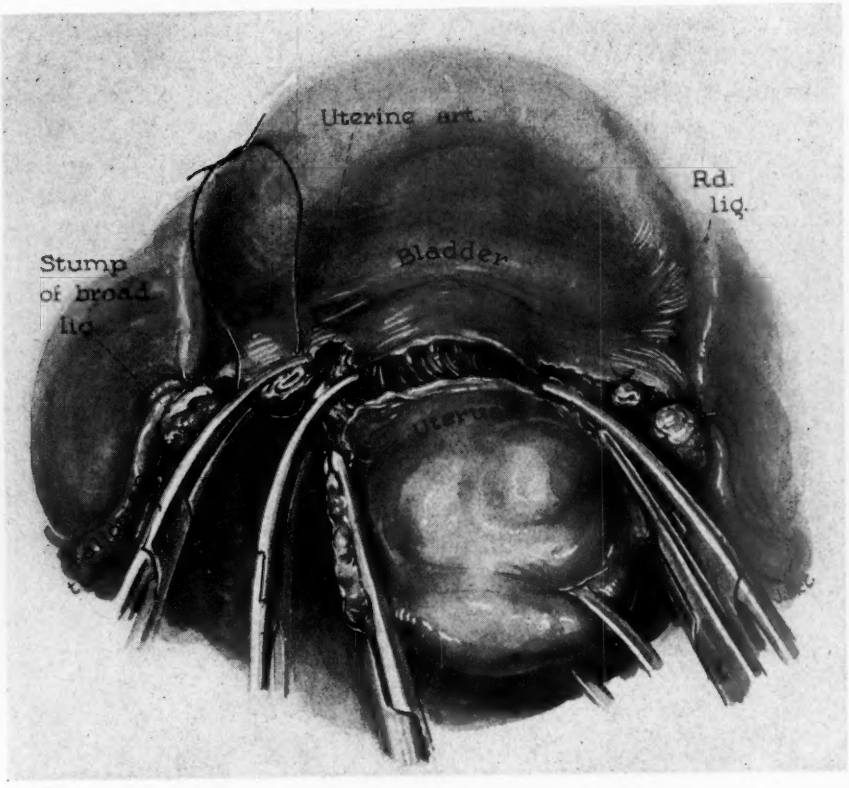
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Fig. 2.

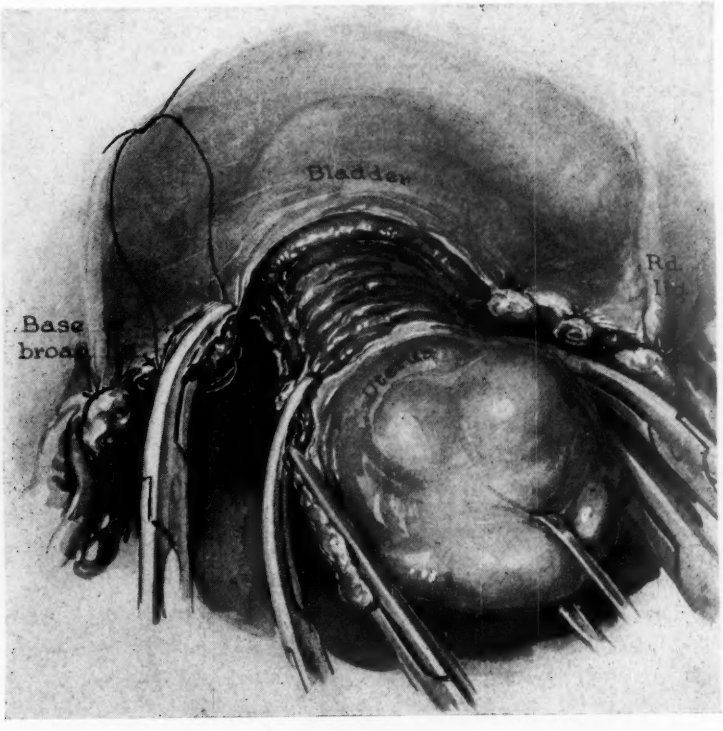
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Fig. 3.

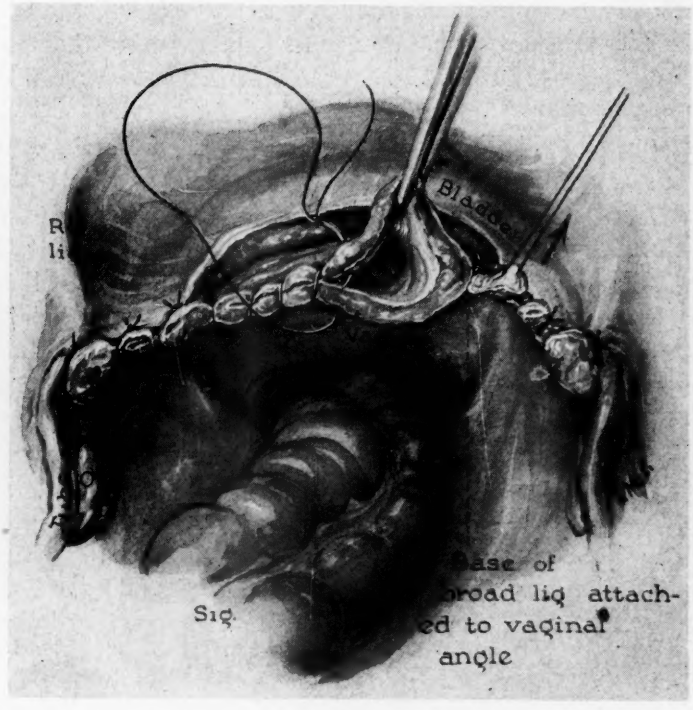
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Fig. 4.

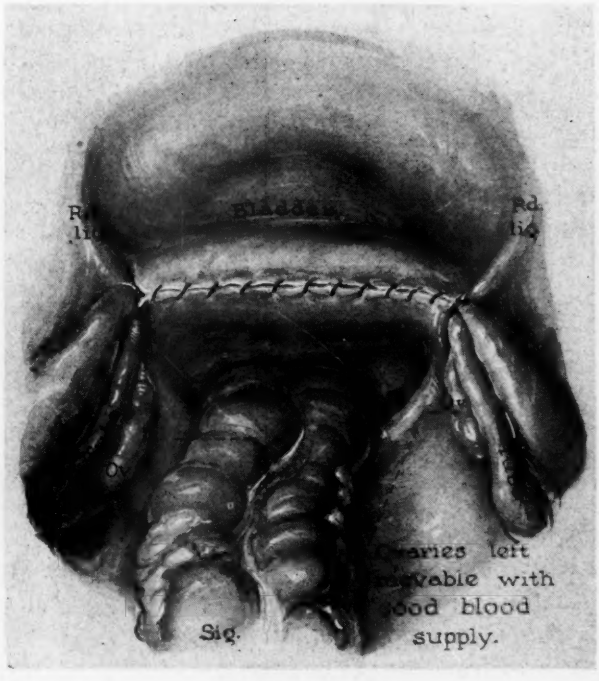
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Fig. 5.

In most cases the operation is practically bloodless until the vaginal wall is divided. Some bleeding always occurs at this point whether the hysterectomy is being done from above or below. It is not great in most cases and is soon controlled by the suture closing the vagina.

The base of the broad ligament is attached to the vaginal angle by a single suture on each side and the vagina is closed. Experience with both interrupted and running sutures for closure indicates the superiority of the latter.

Peritonealization is carried out by means of the vesical flap of peritoneum. Satisfactory closure is almost always attained. When peritonealization is difficult, as in some cases of extensive inflammatory residues, the sigmoid may be utilized. If attached by a few interrupted sutures of fine gut, and not angulated, its function is not disturbed. In cases in which an irregular mass of myomas must be dealt with, or when extensive adhesions are present, and occasionally in the presence of extensive endometriosis, amputation at the level of the internal os is helpful. The remaining cervical stump is usually then removed easily. This is done occasionally, when it seems likely to simplify the operation.

Number one chromic gut, used singly, is amply strong for sutures and ligatures. For small bleeding points on the vaginal vault, and for ligatures in the abdominal wall, number 0 is used. The use of unnecessarily heavy gut, or of double strands of gut, interferes with healing and is not needed either for apposition or for hemostasis.

The criticism is sometimes made that total hysterectomy shortens the vagina. This, in our experience, is not true. If the vaginal wall is cut through, in removing the cervix, close to the cervical wall, shortening does not occur. A recent and excellent text contains a drawing, illustrating total hysterectomy, in which a cuff of vaginal wall of some size is being removed together with the uterus. If this is done, it is obvious that the vagina is shortened. Division of the vaginal wall should be made close to the cervix.

It is important, whether the total or the subtotal operation is done, that the ovaries be left freely movable and with a good blood supply. Firm attachment of the retained adnexa, either to the cervical stump or to the vaginal vault, is not wise. The broad and round ligaments are put upon tension which may cause dyspareunia, and the blood supply of the ovaries may be interfered with which will increase the likelihood of later cystic change.

Our experience indicates that, in trained hands, total abdominal hysterectomy may be used frequently or even almost routinely. For safe use an accurate knowledge of pelvic anatomy is needed together with a well-developed technique. In the absence of these the operation carries with it a risk greater than that of the subtotal operation. With the mortality reported here we feel justified in making use of the operation as freely as we do.

Examination of patients later indicates that a vagina of normal depth may be retained. If this is accomplished, and if the broad and round ligaments are not left tightly stretched, dyspareunia does not occur.

The advantages of the complete removal of the uterus, whether done abdominally or vaginally, are sufficient to warrant its frequent use in active services staffed by trained men.

Discussion

DR. HAROLD O. JONES.—Reports of studies made by groups always yield a pattern of results well worth serious consideration. Dr. Danforth's paper fits into this category. The discussant, however, should not report his results as a comparison, but point out differences of opinion, results, and technique.

The standard of morbidity referred to in this paper is disowned by the College of Surgeons. In our study of morbidity presented to this Society last year, we were unable to find anywhere such a standard. The one referred to was established years ago to apply to uncomplicated delivery of a nulliparous woman. Consequently, it has no relation to any surgical procedure. This is the reason we presented a curve as a norm for morbidity in complete abdominal hysterectomy.

We agree that there should be an ever increasing number of patients of hospital services treated by complete abdominal hysterectomy. In the same way, the number of patients treated by vaginal hysterectomy should increase. These facts, we believe, reflect the progress of the younger men of any group.

Our experience with the occurrence of carcinoma of the cervix has been the same as the author's, and for the same reason sanction the removal of the entire uterus. A more common condition, however, more urgently indicated the removal of the cervix, i.e., chronic cervicitis, where disability is very often exaggerated after operation. The reason offered for leaving an often diseased cervix is that associated conditions have been time consuming, and therefore the operation should be terminated. This we do not believe is often necessary, especially when one considers the fact that almost invariably the associated pathology—residues, or endometriosis, have an almost 100 per cent of diseased cervix. Therefore, in the very condition in which the cervix should be removed, it is often allowed to remain, with its subsequent disability.

Masses densely adherent in cul-de-sac and to the cervix may at times be best treated by opening the vagina anteriorly and removing the adherent tissue from below.

Recently we have seen a patient with an acute ulceration and hemorrhage of the cervix three months after subtotal hysterectomy which could not be differentiated from carcinoma except by biopsy. This tissue also had to be removed.

We would like to ask Dr. Danforth what his impression is as to the number of these patients that had to have cauterization of the vault for granulations? Does he think the type of closure influences this? How many patients had hemorrhages during the hospital stay? Does he get the patients out of bed on the third or fourth day? If so, has it influenced the number of complications? Has he had any eviscerations?

Has the author encountered any prolapse of the vaginal vault in these patients? We have thought the fixation of the uterosacral ligaments to the sutured mucosa a factor of prevention of descent. We agree that complete hysterectomy does not shorten the vagina. If such a condition is found, it quite certainly was present before operation.

We believe Dr. Danforth and others have emphasized the location of the ovaries after operation and made statements which cannot be proved. He stresses that the ovaries lie to the side and free, and cautions about putting them on tension, etc. This fact we cannot support. It seems to us that cystic changes in the ovaries are due to a disturbance in the fundamental circulation to the ovary or its broad ligament anastomosis. I must confess I have put the cervix high in the pelvic plane with tension, and have seen no special pain; I have attached the ovaries well toward the center of the vaginal vault without any disastrous results. As a matter of fact, I would rather believe they do better well suspended than prolapsed into the cul-de-sac.

We have all encountered fistulas of the bladder and ureters. These we believe come from difficult dissection interfering with a terminal vessel in a bladder of ureteral segment with subsequent slough, rather than direct injury.

We conclude with emphasis on Dr. Danforth's opening paragraph to increase the percentage of complete hysterectomies.

DR. IRVING STEIN.—Dr. Danforth's concise report proves that in trained hands, total hysterectomy can be done with a minimal mortality (0.4 per cent). The advantages of removing the cervix and conserving the adnexa when possible are stressed, as well as the necessity of anchoring the vaginal vault with the broad ligaments, rather than the adnexa and round ligaments, which may produce tension.

The question of total versus subtotal hysterectomy has been discussed previously at our meetings, and Dr. Danforth has again shown that good technique, a well-trained staff, and properly selected anesthesia have all contributed to a reduction in mortality and limitation of serious morbidity. I fully agree that the total operation is not to be recommended as a routine for all surgeons, but requires the skill of a specially trained gynecologist. Dr. Danforth beautifully illustrated a workable and adequate technique which enabled him and his staff to accomplish excellent results.

I have employed the Richardson technique by preference in simple cases, but have resorted to variations when large tumors or inflammatory exudates complicated the operation. In some cases, especially where there were fibroids in the broad ligaments, the "key fibroid" principle of Emil Ries is employed. However, my technique differs only in minor details from that described by Dr. Danforth: I use plain catgut instead of chromicized, and as fine a suture as proves adequate. I also employ interrupted circle sutures in closing the vaginal vault rather than the continuous suture, and place a small wick of sulfa-permeated gauze to drain the subvesicle space into the vagina. The drain is removed on the fourth day. I also have used sulfanilamide powder in the peritoneal cavity in some instances; I have noted no harm from its use but am not entirely convinced of the necessity of using this agent to insure smooth recovery.

I recently reviewed 100 total hysterectomies, including 13 Wertheim panhysterectomies; eight of these were done for very early carcinoma of the cervix, four for adenocarcinoma with or without fibroids, one for adenoma malignum of the cervix. In the remaining totals, 80 per cent of the operations were done for fibroids, one for sarcoma of the uterus, four for adenomyosis, and the remainder for miscellaneous diagnoses. The mortality of the entire series was 1 per cent, one patient having succumbed after ureteral injury during the total removal of huge intraligamentary fibroids. There were no deaths after the Wertheim operations.

I fully concur with the opinion expressed concerning treatment of the appendix during hysterectomy and remove it only when it is found to be diseased. In two cases, I have found endometrioma of the appendix. It is very likely that this policy of conservatism in regard to the appendix has resulted in fewer postoperative complications.

In my opinion, the accepted standard of a temperature of 100.4° F. on two successive postoperative days is often of little significance in comparison to the length of the patient's stay in the hospital, as a criterion of morbidity. For practical purposes, morbidity can best be judged on the latter basis. In the 100 cases of hysterectomy which I have analyzed, 52 per cent of those who had total hysterectomy were discharged from the tenth to the twelfth day, 33 per cent from the thirteenth to the eighteenth day, and 15 per cent remained from nineteen to twenty-nine days. In that group where radical Wertheim hysterectomy was performed, three were discharged on the twelfth day, six from the thirteenth to the fifteenth day, and three from the sixteenth to the nineteenth day; only one patient remained thirty-four days. Thus it appears that 15 per cent of the patients were morbid to the extent that their hospital stay was prolonged beyond eighteen days. 85 per cent of the entire group, including Wertheims, had negligible complications, if any.

In the past ten years, I have gradually increased the proportion of totals over subtotal hysterectomies, and, in selected cases, perform Wertheim hysterectomy for early carcinoma. My results warrant a continuation of this policy.

DR. DANFORTH (Closing).—I am rather glad to learn from Dr. Jones that our standard of morbidity is outmoded. I should apologize for forgetting about his presentation. The test is a severe one and gives a rather higher standard of morbidity than we ought to have.

Dr. Jones' point that it is important to remove the cervix for infection as well as carcinoma is well taken. Far more often because of infection do we have troublesome cervical stumps later. I have in the hospital now a woman who had had a subtotal hysterectomy done elsewhere and who came in with an infected stump, bleeding profusely.

Granulations in the vagina do occur. I cannot give you any percentage, but I would say that they occur in probably one in four patients. They are not troublesome, as Dr. Stein pointed out. They can be treated by touching with a tiny cautery, such as we use for cervical cauterization without giving the patient any pain, and are very well taken care of in that way.

The number of hemorrhages was not great. We have had fewer since a running suture was substituted for an interrupted one in closing the vaginal vault.

I have not yet tried to get patients out of bed on the third day. They sit up on a backrest on the third day and go home on the twelfth day.

Dr. Jones' point about the uterosacral ligaments is a good one. The uterosacral ligaments were included in the suture attaching the base of the broad ligament to the vaginal angle.

The ureter has a segmental blood supply and there is sometimes disturbance of this blood supply which may be productive of injury later. Some time ago I had a ureter exposed for four inches. I tied it off and had no trouble.

In broad ligament fibroids the technique as shown on the screen could not be followed. One has to modify it. My own procedure is to split across the top of the broad ligament and enucleate the fibroid before attempting to get the uterine artery on that side. In that way we are far less likely to cut the ureter.

As to sulfanilamide, when it became popular I used it routinely. In the clean cases I could not see much difference. We do not at present use sulfanilamide routinely.

As to drainage, we do not drain at all.

THE MANCHESTER OPERATION, WITH SPECIAL REFERENCE TO PARTURITION AND COMPLETE PROLAPSE

A Report of 206 Cases

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(From the Department of Gynecology and Obstetrics, St. Catherine's Hospital)

CONSISTENT with general agreement as to the nature of the anatomic supports of the uterus, there has come about, particularly in the last decade, a growing appreciation of the necessity of shortening the elongated transverse cervical or cardinal ligaments in the successful correction of prolapse of the uterus. Based on this principle, the Manchester operation has grown steadily in popularity, yet has not been as widely accepted in the United States as in Great Britain.

Genital prolapse is a comprehensive clinical term for descent of the uterus, as well as all manner of loosening and bulging of the vaginal walls, and lengthening of the portio or supravaginal cervix without prolapse of the uterine body itself. It is obvious that no one operative procedure will correct all these constituents of prolapse. The Manchester operation will not correct enterocele or rectocele; and the only possibility of cure of cystocele is an operation which results in restoration of the bladder floor. Even Donald, Fothergill, and Shaw have not made this plain. Prolapse of the uterus, provided no intrinsic pathology demands its removal, may be corrected by an operation which shortens the cardinal ligaments. And if we are of the opinion that levator and perineal supports are relatively unimportant factors in maintenance of normal uterine position when compared with the upper pelvic floor, then permanent correction of uterine prolapse must be effected by shortening the cardinal ligaments.

My own success with the Manchester operation over a period of twenty-eight years, and the satisfaction of my associates make it difficult for us to reconcile our experience with statements that this operation may not be performed upon women during the reproductive period, or for complete prolapse or procidentia.

In the United States, just prior to 1932, operations for prolapse of the uterus largely consisted of vaginal hysterectomy, interposition, reconstruction of the vaginal walls combined with intraabdominal suspension, or fixation of the uterine fundus or cervix, or some type of uterosacral or round ligament shortening.

Pemberton[1] performed a combined vaginal and abdominal operation, often with hysterectomy. Miller[2] reconstructed the pelvic diaphragm and suspended the uterus, but recommended in the elderly either interposition or the Mayo vaginal hysterectomy. Counseller[3] reported a large series of 980 cases in which 696 were treated by vaginal hysterectomy. Clute,[4] Laws,[5] Meshburg,[6] Watkins,[7] and Phaneuf[8] favored interposition or vaginal hysterectomy. All these operators performed a combined vaginal and abdominal operation during the child-bearing age. Frank,[9] reporting 480 prolapse operations of which 200 were

ventrofixations, was so discouraged with results that he planned to perform the Fothergill operation in the young, vaginal hysterectomy in the old, and the Le Fort operation in poor risks. Accordingly, in 1935 Frank[10] reported some 200 Manchester operations with very satisfactory results.

According to Goff,[11] Bissell's technique was based upon shortening of the transverse cervical ligaments. To facilitate this procedure he removed the uterus, restricting the operation to women past the menopause and young women in whom prolapse was marked or associated with uterine pathology; results were excellent. And Bullard[12] published well-controlled end results in 361 operations performed by 30 operators at the Woman's Hospital; 95 per cent of these women were cured by vaginal surgery alone, with Bissell's operation showing the highest percentage of success, or 95.8 per cent in 74 cases.

This outstanding success with vaginal plastic surgery was paralleled by Maier and Thudium,[13] who reported, in 1932, 138 Manchester operations performed between 1918 and 1930, with 97.3 per cent successful correction. They had not hesitated to perform this operation upon 47 women in the childbearing age, 11 of whom had children afterward.

In 1933, Shaw,[14] whose paper, no doubt, has had much influence upon American practice, reported 549 Manchester operations with 96.3 per cent success; 27 women had borne children subsequently, five with recurrence of prolapse. He stated that this operation had been performed by a large number of British gynecologists for thirty-five years on all patients with prolapse, irrespective of age or parity.

In 1934, Gordon[15] reported 152 Manchester operations performed between 1917 and 1933; in 50 per cent of these cases the cervix had not been amputated. Excellent results were reported in 94 cases in which observation had been close and personal for two to thirteen years; in 36 cases in which prolapse of the uterus was complete the end result was very satisfactory. There were 22 women in the childbearing age, six of whom were subsequently delivered without recurrence of prolapse. One patient who had had amputation of the cervix aborted twice in the third month. Two of these patients have been delivered again without untoward incident.

During the ten-year period from 1934 to 1943, 236 women were operated upon for prolapse of the uterus in the Department of Obstetrics and Gynecology of St. Catherine's Hospital, Brooklyn; there were nine operators. With few exceptions, all operations were performed under local anesthesia. There were no deaths. The types of operation performed are tabulated:

Manchester	206	
Le Fort	2	
Vaginal hysterectomy	21	
Interposition	7	(one operator)
Total	236	

End results have been studied in many of these cases in order to discover (1) whether the Manchester operation has a place in the management of prolapse of the uterus during the reproductive period, and (2) whether it is effective in the correction of complete prolapse or not.

Prolapse of the Uterus in Young Women

In this series of 206 Manchester operations there were 36 women less than 40 years of age, 16 of whom were less than 35 years old. Parturition is known to have occurred subsequently in 10 cases. In five of these cases, no details

of labor are available, nor is the actual end result known, except in one case in which prolapse recurred. The essential clinical data of the other 5 cases are set down briefly, with age stated as of time of operation. Prolapse did not recur in any case.

CASE 1.—Aged 26 years. Cervix not amputated. Five years later, ten hours of labor with a 9-pound baby; low forceps and episiotomy.

CASE 2.—Aged 34 years. Cervix not amputated. Four years later, five hours of labor with an 8-pound baby; episiotomy only.

CASE 3.—Aged 32 years. Cervix amputated. Three years later, fifteen hours of labor with a 10-pound, 3-ounce baby. Manual rotation of right occipitoposterior, low forceps, and episiotomy.

CASE 4.—Aged 34 years. Cervix amputated. One year later, three hours of labor with a 10-pound, 7-ounce baby. Low forceps and episiotomy.

CASE 5.—Aged 32 years. Cervix amputated. Three years later, twelve hours of labor with a 5-pound, 5-ounce baby. Lower segment cesarean section for rigid cervix.

Discussion

In young women descent of the uterus is often incapacitating. Complete prolapse, though infrequent, does occur. True, it may be tolerably managed by a pessary, but only with considerable and prolonged inconvenience, discomfort of repeated vaginitis, and no hope of permanent correction. Preservation of the menstrual and reproductive functions is desirable.

The uterus is maintained at its normal level by the fibromuscular structures which traverse the parametrium at the level of the cervical isthmus. Of these the transverse ligaments are the strongest, and so the most important. The round ligaments have nothing to do with uterine support. Ward,[16] who believes that the principle of reefing the cardinal ligaments is a sine qua non if the uterus is to be preserved, and others have pointed out that Sims, Emmet, Baldwin, Olshausen, Schroeder, Reynolds, Alexandroff, Dudley, Hertzler, and Halban all utilized this same basic principle.

The combined operation is performed not because it is a satisfactory procedure for correction of prolapse, but to escape the implications of hysterectomy or the Manchester operation. Though direct evidence is lacking, it is likely that shortening of the intraperitoneal ligaments of the uterus does not interfere with parturition, even though vaginal plastic operations are combined with the procedure. The immediate risk of abdominal surgery, its sequelae, and end result often are not taken into account. Of itself, a vaginal plastic operation may cause interference with rotation of the presenting part, or result in such narrowing or rigidity of the birth canal as to make serious trauma or even cesarean section a possibility. Whether it is proper to weigh the risk of abdominal delivery with the probability of recurrence of prolapse after the combined operation is a pertinent question.

Amputation of the Cervix

If amputation of the cervix has been performed, subsequent pregnancy presents a problem but little different than after the Manchester operation.

Rawls[17] and Hunter[18] have shown that there is a very definite risk in pregnancy and labor following amputation of the cervix. If abortion, which is frequent, should occur, there is increased liability to retention of placental tissue and sepsis. In labor, partial or complete failure of cervical dilatation may occur, even rupture of the uterus. Whether part of the combined operation or the Manchester, amputation of the cervix is not a good operation for women in the reproductive period.

But the cervix need not be amputated in the Manchester operation, even though prolapse should be complete. The cardinal ligaments may be shortened otherwise. It may perhaps be necessary to perform reduction of the portio, but it is my practice not to amputate the cervix when performing the Manchester operation upon young women. Presence of the cervix, after restoration of the upper pelvic floor, helps to prevent displacement of the uterine body into the vaginal axis, thus decreasing the risk of recurrence of prolapse. Hunter,[18] who collected a number of cases of dystocia following amputation of the cervix, modifies the Manchester operation in young women by resecting a circular cuff of mucosa just above the portio, before removal of the triangular flap, in order to facilitate approach to the cardinal ligaments.

The Combined Operation

Richardson[19] advises the combined operation, but believes that the question of sterilization is a pertinent one. Phaneuf[20] says that "It is conceded by most gynecologists that, with few exceptions, young women in the childbearing age should be treated conservatively . . . the operative procedures are fairly well standardized and consist of vaginal plastic repair and intra-abdominal suspension of the uterus;" after the menopause he prefers the Manchester operation. It is the opinion of TeLinde and Richardson[21] that when it is desirable to preserve the function of childbearing, women "are best treated by the combined procedure of a suitable vaginal plastic repair combined with some type of intra-abdominal operation." Recently, however, TeLinde[22] has said that he "performs a round ligament suspension for prolapse only when forced to in young women who insist on further pregnancies, realizing that any type of round ligament shortening is not the best for uterine prolapse and that eventual recurrence of the descensus is probable."

There are no reports of end results after the menopause, and reports of subsequent pregnancy and more immediate end results are scant. Pemberton[1] reported three recurrences after parturition, and Counseller[23] reported good results in but 60 per cent of 150 cases with recurrence of prolapse in 12 cases, 5 of them following pregnancy.

The Manchester Operation

Ward,[24] Frank,[9] Kimbrough,[25] Masson,[26] Counseller,[27] and Tyrone and Weed[28] believe that the Manchester operation has special indications in young women, and advocate it in this type of patient, yet largely their opinions have not as yet been supported by publication of case reports of pregnancy subsequent to operation.

Fothergill,[29] who did not devise the Manchester operation, but modified and publicized it, reported 32 cases of subsequent pregnancy with one recurrence. Shaw[30] was of the opinion that "the operation does not cause trouble in subsequent labors," but that recurrence of prolapse was a possibility. He reported 664 cases with 24 unsatisfactory results; "5 of these had borne children, and the parturition is most probably the cause of the recurrence . . . there were 30 cases of parturition in the entire series, and of these only 5 showed any sign of recurrence." In 1943 Shaw[31] apparently became concerned about recurrence, preferring not to operate upon young women.

Maier and Thudium[13] reported 47 operations upon women in the childbearing age; 11 of these women had 13 children, and one aborted subsequent to operation; 10 labors were normal, and three were instrumental; of the 12 women who had labor, the cervix had been amputated in 10 cases. They recommended the operation as a standardized procedure, since 98 per cent of their patients were cured.

Pregnancy after operation, without complication in labor or recurrence of genital prolapse, has been reported by Leventhal and Boshes[32] (1 case) and Salmon[33] (2 cases).

Williams,[34] impressed with the large number of abortions and premature labors occurring after amputation of the cervix, has reported 60 pregnancies in 45 women following the vaginal plastic operation for prolapse which, he states, is standardized in England. Though he does not say so, this is presumed to be the Manchester operation. Pregnancy occurred 49 times in 37 cases in which the cervix had been amputated, terminating as follows: therapeutic abortion, 4; abortion, 20; premature labor, 8; term delivery, 13; not yet delivered, 4. In eight cases, in which the cervix had not been amputated, pregnancy occurred 11 times, terminating in abortion, 2; term delivery, 6; and still undelivered, 3.

Herzfeld and Tod[35] reported 11 pregnancies subsequent to 132 Manchester operations, with eight normal and three instrumental deliveries, and one recurrence of prolapse.

Our South American colleagues have great appreciation of the Manchester operation, and have had long experience with it. Bazan and Althabe[36] believe that this operation is superior to other methods of surgical management of prolapse in the reproductive age. In 354 cases, they report eight pregnancies subsequently; seven of these women delivered themselves spontaneously, and in one case forceps delivery was indicated for pulmonary tuberculosis. Borras[37] performed the Halban operation in 293 cases, and the Manchester operation in 145, with five recurrences in the first group and two in the latter. Results were highly satisfactory. Subsequent pregnancy and delivery occurred in four cases, but whether after Halban or Manchester is not clear.

At this point it should be said that the Halban operation, as described by Mestitz,[38] so popular in Germany and South America, differs but little from the Manchester operation. The incision for approach to the parametrial tissue is practically the same, yet high vesical fixation with amputation of the cervix is performed if retroversion remains otherwise uncorrected. Mestitz found this operation "unusually satisfactory . . . not only for menstruation but also and especially for pregnancy, labor, and the puerperium. A large series of patients have now been carried through pregnancy, labor, and the puerperium without the development of any pathology or dystocia ascribable to this operation." Schmid[39] elected the Halban operation in 605 cases; only four cases of pregnancy were known to have occurred in twelve years, yet he pointed to the reports of Halban and Mestitz that no trouble of any kind has followed pregnancy.

Lacey,[40] in a collective survey of four- to six-year end results of 521 Manchester operations performed at St. Mary's Hospitals, Manchester, England, reported that 382 operations had been performed during the reproductive period. He found that "330 successes bore 67 children (instruments 32 per cent); 19 improved bore six children (instruments 80 per cent); 33 failures bore 16 children (instruments 62 per cent)." To just how many women these babies were born is not stated. He stated that both failures and "improved" show a higher ratio of labors, and again a higher ratio of instrumental deliveries than successes. That is what one would anticipate, and it is obvious that one can scarcely expect a colporrhaphy or any other operation to stand the strain of parturition better than the normal and natural pelvic floor." Fothergill,[29] whose one recurrence occurred after three deliveries, said at the same meeting: "I formerly thought that an operation for prolapse should prevent recurrence even if the patient had one or more subsequent confinements. But we must remember that the arrangements which nature has provided for the support of the pelvic viscera do not by any means always stand the test of pregnancy and labor. To expect from the surgeon arrangements superior to those designed by Almighty Providence, in cases in which these have already failed, is surely asking too much. All we can demand is that the new pelvic floor shall be as good as the original one and a little better if possible."

All of the cases of parturition subsequent to the Manchester operation which I have been able to find after careful search are reported in Table I. In the majority of these reports it was not possible to discover whether cervical amputation had been part of the Manchester procedure or not. The Halban operation is included because it differs but little from the Manchester, and in the report of Borras the Manchester end results are not separately specified (Table I).

TABLE I.—PARTURITION SUBSEQUENT TO THE MANCHESTER OPERATION

	OPERATION		NO. IN CHILD-BEARING AGE	NO. OF DELIVERIES	SUBSEQUENT RECURRENCE	OPERATIVE DELIVERY
	MANCHESTER	HALBAN				
Maier and Thudium[13]	138		47	13	None	Instrument 3
Shaw[14, 30]	664			30	5	None
Gordon[15]	358		58	18	1	Instrument 8 Cesarean section 1
Hunter[18]	19		19	1	None	None
*Fothergill[29]	156			32	1	Instrument 23
Leventhal and Boshes[32]	51			1	None	None
Salmon[33]	254			2	None	None
Herzfeld and Tod[35]	132			11	None	Instrument 3
Williams[34]	45		45	27	None	None
Bazan and Althabe[36]	354			8	None	Instrument 1
Borras[37]	145	293		4	None	None
Mestitz[38]		Large series		Large series	None	None
Schmid[39]		605		4	None	None
Lacey[40]	521		382	89	33	Instrument 35

*Included in Lacey's figures.

End Results in Complete Prolapse

In this new series of 206 Manchester operations are 89 cases in which all or part of the uterine fundus protruded beyond the introitus. Enterocele complicated many of these cases. Clinical prolapse due to hypertrophy of the supravaginal cervix is not included.

An important prerequisite for appraisal of any operation for a complex lesion like genital prolapse is, after selection of the best plastic method for each patient, an accurate detailed description in the case record of the precise anatomic condition before operation. Observation must continue for several years, how many I am not sure. Because of diversified technique and the uneven quality of the operative materal, comparisons cannot be fairly made of the results of various operative methods and clinics. Success often depends upon the experience of the operator.

For these reasons, though my associates report satisfaction with their end results, with but two failures to correct uterine prolapse in the entire series of 206 cases, I report the end results in 26 personal cases only, in which prolapse was complete with eversion of the vagina and protrusion of all, or in but a few cases nearly all, of the uterine fundus. In one of these cases, previously treated by interposition, the vagina was completely everted and the interposed uterus entirely outside the introitus. These women have been repeatedly examined by me over a period of years, and in no case has prolapse of the uterus failed of correction. End results are very satisfactory, though not all of these women were found entirely free of minor complaints. In the series of 152 Manchester operations which I have previously reported, there were 36 women in whom complete prolapse of the uterus was corrected. Recently, 14 of these women have been re-examined by me and found to have remained cured.

Not every one has accepted the evidence that the Manchester operation is effective in correction of complete prolapse of the uterus.

Heaney[41] believes that "the operation has no place in the treatment of complete procidentia. If a case of procidentia is to be cured by vaginal operation, the uterus has to be removed." Tyrone and Weed[28] say "its advocation for procidentia is to be condemned." TeLinde and E. H. Richardson, Jr.,[21] say that the Manchester operation "is nothing more than a radical anterior colporrhaphy. . . . It does very well in the cure of cystoceles with first and at times second degree descensus, but it hardly seems a logical procedure when there is a complete procidentia."

The Manchester operation is a rational procedure for complete prolapse. As a matter of fact, the operation is not only more readily performed in this type of case, and so, more expeditiously, but anatomic identification is more precise. The transverse cervical ligaments are more readily found because of compensatory work, hypertrophy consequent to slow descent or genital prolapse of long standing. The satisfactory end results reported by many operators speak for themselves.

Summary and Conclusions

1. Methods of surgical correction of uterine prolapse in the United States just prior to the last decade are reviewed.

2. End results of 206 Manchester operations have been studied in order to discover the value of this procedure during the reproductive period. Parturition occurred subsequently in 10 cases. In a series of 152 cases previously reported, eight babies were born to six women.

3. The relative merits of the combined operative procedure and the Manchester operation for the surgical correction of uterine prolapse during the reproductive period of life are discussed. The Manchester operation is recommended.

4. Reports of parturition subsequent to the Manchester operation are discussed and tabulated.

5. Whether the Manchester operation is suitable for women in the reproductive period is a question of great importance since its alternative, the combined operation, is not satisfactory. Operations for correction of prolapse of the uterus are, for the most part, performed after the menopause, and comparatively few cases of subsequent pregnancy have been reported. Up to now, no survey of the entire subject has been made. Some gynecologists remain unconvinced that women may be safely carried through parturition without severe dystocia or serious damage to the plastic end result. Yet many who have performed this operation upon young women have reported no serious dystocia or any pathology in the puerperium. The incidence of forceps delivery may be discounted, since instrumental delivery through a wide episiotomy is advisable after any plastic vaginal surgery. The possibility of cesarean section, though remote, must be taken into account, particularly if the cervix has been amputated. Even complete prolapse of the uterus may be corrected without this dangerous procedure.

6. The Manchester operation has given excellent results in 62 cases of complete prolapse in which observation has continued for long periods of time.

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32 REMSEN STREET

AN EVALUATION OF EXTRAPERITONEAL CESAREAN SECTION*

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THE major cause of mortality from transperitoneal approach to the pregnant uterus is peritonitis. Thus, in our own service of six deaths following and due to, cesarean section, employed because of fetopelvic disproportion, all were due to peritonitis. All exceeded our own strict standard of conditions to be later specified. Where such approach through the general peritoneal cavity is used in late neglected cases, the mortality is so high as to have been described in the past as "frightful." Where, however, it is reserved for early uninfected cases, mortality in accomplished hands approaches nil.

Of course there have been refinements in the techniques of transperitoneal operation, and some authorities have felt that these refinements, particularly with the use recently of powerful antibacterial agents such as sulfonamides and penicillin, would suffice to overcome the peritoneal hazard of cesarean section, even in cases in which its conditions were not ideally fulfilled. Our own conviction is that this is not true. We recognize the superiority of the newer techniques of lower segment operation so strongly as to have practically outlawed the classical operation in our practice. We do not feel that that technique sufficiently protects the general cavity against infection and the spread thereof. Hence the same restrictions as to the proper applicability of transperitoneal cesarean section apply to the most improved techniques in almost the same degree as to the classical type.

There still remains, therefore, the problem of the elimination of peritonitis from obstetric practice. As has been indicated, no expedient involving the broad invasion of the peritoneal cavity is competent to do so. In relation to cases not exhibiting proper conditions for such operations, several expedients are available.

1. *Delivery of all such cases by the vagina.* This may involve considerable immediate danger, craniotomy applied even to the living child, and a degree of maternal soft parts trauma, inviting disaster just as surely as would unsuitable application of transperitoneal section. (a) That such difficult vaginal delivery is relatively safe is not borne out by experience. Thus, of 101 deaths in our clinic due to purely obstetric causes, 12 patients died of hemorrhage or sepsis directly dependent upon difficult vaginal delivery. This expedient is, therefore, by no means a competent answer to the problem. (b) Besides the immediate dangers inherent in it, as reflected in mortality, there is occasionally involved, when this course is inexorably followed, the deliberate sacrifice of a living fetus. Such a procedure, no matter what the estimated prognosis as to the survival of a particular fetus may be, is so abhorrent to the refinement of

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modern surgical technique that it should be considered wholly obsolete and outlawed. (c) Added to this is the frequent incurrence of such damage to the mother's soft parts as may lead to subsequent tragic gynecic disability.

2. *Cesarean-hysterectomy,* generally historically mistakenly called the Porro operation. This is objectionable in that it is used in already seriously ill patients, necessarily poor operative risks. Under such circumstances it is a formidable procedure, and its immediate mortality must be high. We have no experience with the use of this operation for already existing uterine infection. The Chicago Lying-in service shows a mortality from this procedure of 1.4 per cent. In a comparable table with three other clinics, none approaches this very low figure. One of them is fourteen times that rate, the average more than four times as great, and a collective series attributed to Irving shows ten times that rate.

There is no evidence that these reported series are critically broken down to include only cesarean-hysterectomies performed for fetopelvic disproportion. Dieckmann does not even indicate such a breakdown for his own exceedingly low figure. Certainly all of our cases, and doubtless some of his, and those quoted from the other clinics, as well as Irving's series, were done for other indications, which of their own nature contributed importantly to the mortality rates shown. Even this uncritical grouping of cases, however, does exemplify a serious hazard incident to this procedure. Baldwin's results in the treatment of certain cases of puerperal infection by hysterectomy, which Dickmann says prove conclusively that extraperitoneal section is not as safe as cesarean-hysterectomy, actually shows a 25 per cent mortality! Briscoe, quoting Lull, states that the Philadelphia statistics markedly show "the very high death rate from the Porro operation which is usually thought of as the procedure of choice in the infected case." He shows that a ratio of the Porro operation to all sections, of 1.8 per cent, resulted in 10 per cent of all section deaths. Twenty-seven Porro operations showed an absolute mortality rate of 11.1 per cent.

3. *Marsupialization and exteriorization of the uterus.* We have not had, and I hope never will have, any experience with these procedures. I quite concur with Dieckmann's statement that they have no place in modern obstetrics.

4. *Exclusion operations.* There is no doubt that these operations have saved many lives. I have felt this to be true in a few cases in my own hands through the years, and Cooke's remarkable series of his own special modification of peritoneal exclusion by utilization of the round ligaments attests the value of such procedures. In our own hands, however, and I think in general experience, it must be conceded that these procedures are unreliable. The suture line, depended upon in all of them for the walling off of an artificial "lesser peritoneal cavity," so to speak, from the general cavity, is not entirely impervious to the transmission of infection, and is frequently injured or torn in the manipulation of extraction. This fact is recognized, for instance, in Irving's expedient of reinforcing the peritoneal suture line by the inclusion of fascia in his "artificial wall." When damage to, or destruction of, this artificial wall does occur, it is apt to be extensive and thus defeat the whole object of the technique. In Cooke's experience, he frankly states that peritonitis in the artificial lesser cavity occurs, and his cases are subjected to a long period of drainage and a greatly increased length of hospital stay.

5. *Extraperitoneal cesarean section.* This operation is by no means new. It was proposed and indeed practiced more than a century ago. An active recrudescence of interest in the procedure, with the development of many modifications of technique, occurred more than a generation ago. This interest and practice has continued since that time. During a part of this period American interest centered in the possibilities inherent in the development of the exclusion

operations. For the past fifteen years, however, there has been increased interest in, and use of, true extraperitoneal section, with particular attention to two general types, the Latzko and the Selheim procedures, both of which have been modified and refined by several American investigators.

To our minds, this type of procedure much more nearly fills the need for the protection of the parturient against the risk of fatal peritonitis following cesarean section than do any of the other alternatives already listed.

As evidence of the concurrence in the belief in this value, a very cursory review of recent literature reveals its widespread use.

The belief which I have just expressed in the value of this operation and its apparent sharing by many men, is not shared by everyone. Briscoe says that in the discussion of Lull's paper in 1943, it "was generally agreed that there was little need for the extraperitoneal operation." (It is not implied that this is Briscoe's own opinion.) In his recent most excellent review of cesarean section mortality, William J. Dieckmann concedes that the extraperitoneal section is theoretically ideal, but concludes that this operation is not the proper treatment for the infected case. In support of this conclusion he points out that, due to accidents of technique, the peritoneum is frequently perforated and that once this has occurred, the procedure thereby ceases to be extraperitoneal, and no protective efficacy can be imputed to it.

This is, of course, theoretically true. As a matter of experience, however, it is not valid. The potential or even actual soiling of the peritoneal cavity through a small rent in its lower portion, especially if the chance of such soiling is minimized by the recognition and repair of that damage *before* the uterus is opened, is not greatly hazardous. It is a very different thing from the massive spill of infected amniotic liquid which occurs in transperitoneal operations, no matter how elaborate the packing, or other means of limiting such effect may be, or of the continuing leakage of infective material through a broken-down uterine incision so graphically described by Dieckmann himself. This accidental wounding of the peritoneum is admittedly frequent, but the relative safety of the extraperitoneal operation is too extensively established to be questioned.

Ricci quotes P. Baum, who, in 1923, reported 133 extraperitoneal operations in which the peritoneum was torn in half the cases, with a mortality of 1.5 per cent. Waters in 250 cases found injury to the peritoneum in 27 per cent, with a gross mortality of 0.8 per cent. Irwin reports 285 collected cases by 11 surgeons, in which the peritoneum was opened 50 times (17.5 per cent). There was no peritonitis in these 50 cases, and only one case of peritonitis in the whole series. He adds 32 cases of his own, with the peritoneum opened five times (15.6 per cent) with no deaths. Daichman and Pomerance report 100 cases with 33.3 per cent of peritoneal injury without a death. Aldridge, Bourgeois, ourselves, and others have deliberately wounded and repaired the peritoneum before opening the uterus. All such injuries and repair, at worst, are less extensive and less dangerous than the wounding involved in "exclusion" operations. Dieckmann further says that large numbers of these operations are performed on cases which are not actually infected, and that therefore mortality statistics referable to all operations of this type cannot be depended upon as a valid index of its protective efficacy in badly or actually infected cases.

This is perfectly true. But a sufficiently large number of the many hundreds of cases reported *have been* for demonstrably infected cases, as to have very dramatically demonstrated the value of the operation. Certainly the pioneers in the development forty years ago of the basis of modern practice were sufficiently often confronted by "badly" infected cases to spur their adventure in evolving new techniques. Kuschner (quoted by Ricci and Mahr) said in relation to 72 cases reported in 1912, "No degree of infection had contraindicated the operation." Steele said of all his cases that there was "no doubt concerning the probability of infection." Waters reports 90 out of 250 cases definitely showing preoperative morbidity or sepsis. Irwin states that all his cases were "infected, or potentially infected."

Ricci and Marr state that extraperitoneal section "should displace all other types of cesarean in infected and mismanaged cases." Dieckmann speaks of of its application to "the infected case," and, in a private communication, implies that its only proper value is in "neglected" patients. Our concept of its value is not so restricted. It is, therefore, desirable that we attempt to define what is meant by "infected," "mismanaged," and "neglected" cases.

We would propose that all cases subjected to cesarean section for fetopelvic disproportion be divided into the following:

I. *Clean cases.*—

1. Cases not in labor, nor with membranes ruptured, nor subjected to any manipulation, nor showing any intercurrent infection.

2. Cases same as 1, except with only short period of labor, with membranes ruptured not in excess of a minimal time.

II. *Potentially infected cases.*—

1. Those in labor more than twenty-four hours.

2. Those with membranes ruptured more than twelve hours.

3. Those with any other manipulation than a very few rectal examinations and/or one ideally guarded vaginal examination.

III. *Actually infected cases.*—

All those which, in addition to the factors constituting potential infection exhibit

1. Exaggeration of those factors, as (a) excessively long, exhausting labor, (b) membranes ruptured two or more days, (c) excessive number of carelessly made examinations, or manipulation embraced in attempt at induction of labor, or artificial vaginal delivery, *plus*

2. Actual clinical signs of infection such as intrapartum chills, fever, rapid pulse, dehydration, follow amniotic liquid, excessive leucocytosis, positive cultures for pathogenic organisms in amniotic liquid or blood-stream.

The worst cases of this group probably constitute what are called the "mismanaged" or "neglected" ones.

Notwithstanding the best programs of community and medical education, maternity services will continue to receive occasionally badly neglected, mishandled, and already dangerously infected patients, many of these already complicated by hemorrhage and shock. If our idea of what constitutes an infected case embraces only this group, differences in the evaluation of procedures may very well be minimal. This group will show a considerable mortality, no matter what the method of delivery is. We would certainly concur with Dr. Dieckmann in preferring to handle the majority of them conservatively,

with primary attention concentrated on improving the general condition of the patient, in contemplation of vaginal delivery where possible.

But even in this group of cases, when it *is* necessary to do any supra-symphyseal operation, extraperitoneal section would still appeal to us as giving the patient a better chance of survival than transperitoneal cesarean-hysterectomy, both from the risk of peritonitis and from the fact that the latter operation is surgically more formidable than the former.

But Dr. Dieckmann himself, in his summary, would appear to include a much broader group of cases in those which he is unwilling to submit to transperitoneal section. Thus he states, "Total cesarean section mortality can be kept below 1 per cent by the following evaluation of the case: Are there any of the following contraindications present? (a) Ruptured membranes over twenty-four hours. (b) Labor over twenty-four hours. (c) Repeated rectal or vaginal examinations."

These three contraindications to transperitoneal section constitute the above proposed definition for potentially infected cases. This group

1. Cannot be sectioned through the peritoneum, as Dieckmann states, and we thoroughly believe, without incurring more than minimal mortality.
2. Some cannot be delivered vaginally without inordinate prolongation of labor and heightened fetal risk.
3. All certainly should not be subjected to cesarean-hysterectomy.

We believe that those not susceptible to relatively facile and safe vaginal delivery, *should* be delivered by extraperitoneal section. We further believe that the application of extraperitoneal section to this group *constitutes its greatest value.* It is an important item in the obstetrician's armamentarium which increases the flexibility of his resource in best managing this, in our experience, very important group of cases.

How important is it? Schumann has indicated that any obstetrician of competence should be able to make so accurate a prognosis that hardly any case should disappoint predetermined possibilities of vaginal or abdominal delivery. In our clinic we are not so omniscient!

McKelvey more reasonably says: "Complete clinical and x-ray study will not separate pelvic dystocia problems into two absolute groups, one for certain spontaneous delivery, and another for section." "There is a doubtful range at the inlet, at mid-pelvis, and four or five . . . at the outlet." Not only is this statement true as regards clinical and x-ray study, but this "doubtful range" is broadened by the impossibility of accurate pre-estimation of the intangible functional factors concerned in labor. Perhaps we have been so intent on trying to improve prognostic resource by refinements in study of the configuration and size of the pelvis that we have too often forgotten that the woman in labor is something more than a skeleton. Prognosis entirely based on estimation of the resistances to successful delivery, which ignores the functional capacity of the woman, with special reference to her uterus and, to some extent, even her psyche, will lead to serious pitfalls and sad errors of judgment. This functional status cannot

be tested before labor. So, while we may concur with McKelvey that "The doubtful range is now very narrow," we cannot agree that all in this range should be electively sectioned, and "the test of labor and late section have disappeared." On the contrary, we believe that *all* cases in the "doubtful range" should have the benefit of a test of labor, and Greenhill, in an editorial comment on McKelvey's paper, would appear to favor a test of labor for many of the cases which McKelvey would electively section. If this plan is carried out, procrastination on the basis of reasonably justifiable hope will sometimes lead to disappointment. The case will be thrown into that category unsuitable for transperitoneal section, but definitely requiring abdominal delivery.

Just how narrow is the incidence of such cases? In a survey of labor some time since, we found that 6 per cent of our clinic material remained in labor more than thirty-six hours. Of these, more than a third delivered spontaneously in vertex; about 11 per cent were sectioned. The latter cases would therefore be 0.66 per cent of our total cases. They should all, according to our practice standard, be sectioned by the extraperitoneal method. If to this 0.6 per cent were added the cases between twenty-four and thirty-six hours of labor, the incidence of extraperitoneal section would be somewhat higher. But it is altogether not an especially formidable statistical figure, and is not as large as the number of unnecessary sections done by those who never permit their cases a test of labor.

Summary

1. There is, as there always has been, a need to protect the parturient woman against peritonitis.

2. No method of transperitoneal approach, except within the rather narrow limits of a strict set of conditions as to time and other factors, is adequate to do this.

3. Other available methods of delivery include (a) delivery by vagina, not always safe for mother or child; (b) cesarean-hysterectomy, mutilating, formidable, dangerous; (c) marsupialization and exteriorization of uterus, appealing so little to good surgical standards as not to rate discussion; (d) exclusion operations, relatively unreliable in efficacy; (e) extraperitoneal section, established by our experience as in a high degree safe and efficacious.

4. A definition of clean, potentially infected, and infected groups is offered.

5. Extraperitoneal section is applicable to the most desperate of the infected group.

6. Its greatest value, however, is in its application to the *potentially* infected group.

7. This group, though of small percentage incidence, is not yet capable of entire elimination from even capable experience.

8. Extraperitoneal section is an important resource of the obstetric armamentarium in the proper management of all potentially infected or infected cases.

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Discussion

DR. W. J. DIECKMANN.—The extraperitoneal cesarean section is theoretically ideal for all patients where it can be performed. I agree with Dr. Cosgrove that it is much safer than the laparotrachelotomy in potentially infected patients. I do not believe it is as safe in infected patients as vaginal delivery or cesarean-hysterectomy. The latter operation, in my opinion, is *the safest treatment for infected patients.* Extraperitoneal cesarean section should be performed only by the experienced obstetrician who has a sufficient number of clean patients requiring cesarean on whom he can learn the technique. The occasional operator should not attempt the extraperitoneal or, in fact, any type of cesarean section.

Dr. Cosgrove states that craniotomy on a living fetus is abhorrent and that it should be considered wholly obsolete and outlawed. I do not agree with him because after a patient has been in labor for twenty-four to thirty-six or more hours, the number of stillbirths increases steadily, and many fetuses do not survive, even if delivered by cesarean section. Some who do survive show evidence of intracranial injury and are better off dead.

Dr. Cosgrove questions our mortality of 1.0 per cent for cesarean-hysterectomy. He is correct. This figure is weighted by many hysterectomies on clean patients. We are now trying to determine just what our mortality is in cesarean-hysterectomy for the treatment of infected patients.

For many years, I have felt better after a cesarean-hysterectomy than after any type of cesarean section. The postpartum uterus is an excellent culture tube because of its poor blood supply, and I believe that many women would be alive today had the uterus been removed at cesarean section or very early in the septic puerperium.

I stated in a recent paper that Baldwin's results in the treatment of puerperal infection by hysterectomy proved conclusively that cesarean-hysterectomy was a safer operation than the extraperitoneal section. Cosgrove questions the validity of this statement because Baldwin had a mortality of 26 per cent, and their mortality in extraperitoneal section was only 0.8 per cent. Of Baldwin's patients 77 per cent had pus in the uterine wall or in the

tissues about the uterus at the time of the operation and I believe that the mortality without operation would have been close to 100 per cent. He had a 30 per cent mortality in his first 67 cases, 18 per cent in his next 17, and no deaths in the following six.

Dr. Cosgrove states that cesarean-hysterectomy is a formidable operation. Many doctors have this idea, and therefore do not perform this operation except in the absolutely necessary cases. Their operating time will therefore be slow, and there will be much spill.

What is most important, they may amputate too high, thereby defeating the purpose of the operation, which is to remove all of the uterus.

Dr. Cosgrove states that soiling of the peritoneum can be easily prevented with the extraperitoneal approach. This is an obvious fact, and it is for that reason I favor the extraperitoneal. Any hole in the peritoneum, protected only by catgut or even a nonabsorbable suture, is a weak point for leakage of infected material (lochia) into the peritoneal cavity. I do not believe the patients die from peritonitis as a result of the immediate soiling, but from the leakage through the incision or hole in the peritoneum. The fact that the authors have collected over 667 patients with 152 (23 per cent) perforations of the peritoneum with a very low mortality, does not prove the safety of the operation.

We have set up at the Chicago Lying-in Hospital certain contraindications against the low cervical cesarean section because our experience and the experience of others indicate that if one oversteps these, the morbidity and mortality are markedly increased. These are as follows: (1) labor and/or ruptured membranes over twenty-four hours, (2) attempts at delivery by forceps or version, (3) induction of labor by bag, bougie, or pack, (4) evidence of uterine infection, (5) repeated rectal or vaginal examinations, and (6) a dead or damaged fetus.

We have undoubtedly performed a number of unnecessary sections, but the fact that we have had only nine deaths (five from infection) in over 2,000 cesarean sections, speaks well for our safeguards. I have performed cesarean section with no maternal mortality on a number of occasions after each contraindication listed above, but I had been in personal charge of the entire labor. I think the time interval between intrauterine manipulation and the operation is important.

Indications for craniotomy or cesarean-hysterectomy.—(1) A bag, bougie, or pack has been in the uterus for twelve to twenty-four hours or longer, (2) labor for twelve or more hours after *attempts at delivery,* (3) foul-smelling amniotic fluid, (4) repeated vaginal examinations with hands or unsterile gloves, and (5) labor of thirty-six to forty-eight hours or more associated with: (a) temperature of 38.5° C. or more, (b) chills, (c) positive blood culture, (d) pathogenic organisms in the amniotic fluid in *large numbers* and associated with (*a*), (*b*), or (*c*). (6) More than twelve rectal or six vaginal examinations.

The mere statements by various authors that the patients treated by extraperitoneal section were infected is very doubtful evidence. I question the need for the extraperitoneal type in all of the 250 cases reported by Waters, since 140 were presumably clean cases and only 90 had preoperative morbidity or sepsis. Sixty had positive uterine cultures. Preoperative fever is no absolute criterion for infection, nor are the positive uterine cultures, even though 56 showed pathogenic organisms.

Several years ago, Adair and Ira Brown reported our results in taking cultures at cesarean section. It is worth noting that 28 per cent of the cultures were positive before and after opening the peritoneum, but 64 per cent were positive before closing the peritoneum. I do not know when Waters took his cultures. I would be more impressed if they were taken before the baby was delivered and if some attempt were made to determine the number of bacteria.

We have performed six sections according to Waters' technique. None were indicated, but the last one had a septic course. The patient had been in labor only twenty-four hours and recovered without other complications, but the baby died within twenty-four hours from pneumonia.

Dr. Cosgrove reports 483 extraperitoneal sections with six maternal deaths, a rate of 1.24 per cent. Five of the deaths were from infection. Since most of these operations were performed in potentially infected patients (whom we would have delivered vaginally or by

cesarean-hysterectomy) and some in infected patients, the low mortality demonstrates the increased safety of the operation over that of the transperitoneal low cervical.

I am pleased to note that Dr. Cosgrove and Dr. Waters are stressing the value of the extraperitoneal section in *potentially* and not actually infected cases. This distinction is important because the reputation of the Margaret Hague Hospital and its staff will stimulate many doctors to practice the Waters' operation in unsuitable cases. The results would be an increasing mortality from section instead of a decreasing.

My own experience, as well as all the available evidence, demonstrates beyond question that the infected patient should be delivered vaginally if it can be done without too much trauma, otherwise, by cesarean-hysterectomy. In the latter operation the entire corpus must be removed, spill must be kept at a minimum, adequate drainage provided through the cervix and vagina, and a peritonitis routine instituted for forty-eight hours or more postoperatively. If sulfonamides and penicillin are administered prophylactically, the dosages must be large and the urine volume maintained at 1,400 c.c. per twenty-four hours.

DR. FREDERICK H. FALLS.—When I was asked to discuss this paper my first inclination was to refuse because of a very limited experience with the extraperitoneal operation. The reason for this lack of experience is that we have been busy in our clinic with a different problem in cesarean sections, namely, to determine whether the low cervical or classical operation is the better operation. We have been doing every other case by the low cervical method since 1930. We have felt that it may be of interest to discuss Dr. Cosgrove's paper from a negative angle, that is, what happens if you do cesarean section and do not use the extraperitoneal method.

We have had approximately 20,000 cases and, of these cases, 285 have been delivered by cesarean section. Among these, six deaths occurred, a mortality of 2.1 per cent. Of these, two were due to peritonitis following operation, which gives a mortality rate of 0.7 per cent for this complication. Of the 285 cases, 122 were classical cesarean sections in which there were two deaths; 142 were low cervical cesarean section in which there were no deaths. Twenty-one were Porro cesarean sections in which there was one death attributed to pre- and postoperative hemorrhage from a ruptured uterus.

We do not share Dr. Cosgrove's fear of the classical cesarean section resulting in peritonitis and death, since we lost only two patients from peritonitis in this group, and one of these had a serious toxemia which may well have been the deciding factor in producing the infection. These were all done without the use of sulfonamides in the wound, or taken by mouth, or intravenously administered before or after operation.

In 142 low cervical sections in which no deaths occurred, there were no exceptions made for potentially infected cases. Twenty-one so-called Porro operations were done, only two of which were considered necessary because of the presence of actual infection. One had a carcinoma of the rectum with rectovaginal fistula, and the other a long labor with a long period of ruptured membranes with infection present. Both of these mothers survived the operation, as did their babies. The remainder of the Porro operations were done for various reasons, such as ruptured uterus, premature detachment of the placenta, fibroids, and such complications. We do not feel that this operation must be reserved for seriously ill patients any more than that the extraperitoneal operation must be so restricted. It may be done in patients running a low grade temperature in which it is feared an active infection is present. It may be done for an intercurrent infection such as a pneumonia, typhoid, appendicitis, and I have even done one case successfully in a patient with erysipelas of the face, toxemia of pregnancy and subacute gonorrhea. Technically, the operation is not difficult. It can be done under local anesthesia and the shock is very little, if any, greater than that of an uncomplicated cesarean section. If done before the patient is allowed to become a poor risk because of procrastination on the part of the obstetrician. The advantage of this procedure is that it removes the possibility of the patient developing a fatal puerperal sepsis, since there is no uterus to become infected.

We hardly agree with Dr. Cosgrove in adopting a conservative attitude in labors of twenty-four and thirty-six hours, and feel that in the absence of demonstrable infection, if

cesarean section is necessary for any reason, we would prefer the low cervical section, since the statistics in our series at the present time seems slightly to favor this operation.

The question has been raised of the need to sacrifice the living baby by delivery per vaginam in cases of outspoken sepsis. At the time this decision is made, it must be remembered that not all of these babies will survive if delivered by cesarean section, in fact, many of them have been infected secondarily to an ascending placentitis long before the decision to operate is made. These will be found to have a septicemia at birth from which many do not recover. I certainly would not hesitate to sacrifice a fetus which I thought had very little chance of survival in order that I might increase the chances for the survival of an infected mother by delivery from below. In the overwhelming majority of such cases we have been able to deliver after craniotomy without significant subsequent gynecologic pathology.

Recently we have put all such patients on sulfonamides and penicillin prophylactically. As soon as the membranes ruptured we have been able to demonstrate sulfonamides in the amniotic fluid and blood of the infant. While we do not have comparative figures, we are of the opinion clinically that we have reduced our fetal mortality and morbidity by this means.

I would like to ask Dr. Cosgrove what his statistics show as regards fetal salvage in those cases in whom a frank infection was present at the time of operation.

Another question which frequently is brought up in connection with the discussion of these operations is the number of bladder injuries which have to be repaired during the operation, and of this number what per cent developed vesicovaginal fistula, and of this group what per cent have to be closed surgically.

DR. JAMES E. FITZGERALD.—I would like to ask Dr. Cosgrove whether he has delivered any of these patients from below after they have had the operation described.

DR. LOUIS RUDOLPH.—I would like to ask Dr. Cosgrove what is his test of labor.

DR. STUART ABEL.—How much technical difficulty is encountered in attempting extraperitoneal section after a previous cesarean section?

DR. W. C. DANFORTH.—I would like to ask whether there have been deliveries from below after extraperitoneal section, and whether the incidence of rupture of the uterus is greater or less than it is after low cervical section.

DR. A. F. LASH.—I would like to ask Dr. Cosgrove whether they have employed the Hillis impression method. We find it of great help here in determining whether we have disproportion in borderline cases.

DR. COSGROVE (Closing).—I have, I think, accomplished my purpose in coming here tonight if I have been able to impress upon you that the whole discussion of extraperitoneal section as opposed to the Porro operation is not limited to the actually severe infected cases. My chief point is the applicability of extraperitoneal cesarean section to a group potentially infected which Dr. Dieckmann and I agree should not be subjected to the transperitoneal operation.

Dr. Falls' discussion of the relative safety of the classical section and the lower segment section is most interesting. He has pointed out that he prefers doing a lower segment operation because of the lessened mortality.

Dr. Dieckmann has made reference to the sleepless nights we used to have after doing cesarean section. The expectation was that we should have two or three days' hard struggle before we were sure the patients were safe. The reason for the change is better preparation and better anesthesia and not altogether the shift to the lower section operation.

Bladder injuries have not been very frequent. We reported fatal results of bladder injury in one of our cases. I recall another in which I severed the ureter in doing a Latzko, but I was able to repair it. Bladder injuries are more apt to attend the Latzko type of operation and, when they do occur, they are somewhat difficult to repair. These patients

had no persistent fistula, nor did they require subsequent surgery to repair the results of bladder injury. In the supravaginal type of injury of the bladder it is very handy to repair it without leaving any fistula. These injuries are easily recognized.

We have had a few spontaneous deliveries after extraperitoneal section. I have no statistics as to the number. We have just this week reoperated upon a patient who had had a Latzko several years ago. I did a low transverse operation, and it was remarkable how simply the bladder separated from the uterus. There was not the slightest technical difficulty in the usual approach to the lower segment.

What is our test of labor? The test of labor is continued in our hands so long as the patient is making actual progress in labor commensurate with the best estimation we can make of the efficacy of uterine activity. We do not put any time limit on it. That, of course, places the decision on the judgment of the operator or observers.

The technical difficulty of this extraperitoneal section after previous cesarean section I do not think has been tested in our hands, because if a woman has a history of previous section for cephalopelvic disproportion, she will hardly be subjected to so long a test of labor as to require resort to the extraperitoneal type. I do not recall an instance of resort to an extraperitoneal operation in a patient who had had a previous cesarean section because of cephalopelvic disproportion.

Rupture of the uterus we have not seen following extraperitoneal cesarean section, nor have we seen massive calamitous rupture of the uterus after any lower segment operation. That brings up the question, what is meant by rupture of the uterus? Is it simply solution of continuity of the wall of the uterus Then we have had rupture following lower segment operation, in that we have had incompletely healed primary incisions, sometimes with the membranes shining through, constituting a solution of continuity of the myometrium. We have never had an extensive "blowing-out" rupture, with extrusion of the fetus in any type of lower segment operation.

We make extensive use of the Hillis impression method and value it highly.

A DISCUSSION OF PELVIC VARIATION AND A REPORT ON THE FINDINGS IN 100 NEGRO WOMEN*

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FROM time to time the author and his associates have reported on the architecture of the bony pelvis in various groups of our population as it is revealed by roentgen investigation. The more recent of these communications include: "A Study of Pelvic Type in 582 Primigravid White Women, 104 Student Nurses, and 107 Young Girls," in 1939[1]; "An X-ray Study of the Pelvis in 69 Adult White Males," in 1939[2]; "A Comparative Study of the Male and Female Pelvis," in 1940[3]; "A Clinical Study of Roentgen Pelvimetry in 1,100 White Women," in 1941[4]; "A Clinical Study of the Pelvic Midplane in 153 White Women," in 1944; and "A Study of the Growth and Development of the Pelvis in 107 Individual Girls Before, During, and After Puberty," in 1944.[5] The present study adds to this group findings in 100 adult Negro women delivered of their first full-term child on the wards of the New Haven Hospital. As in previous clinical studies, these cases represent a consecutive series, except that in the present instance the sequence is broken into two groups of 71 and 29 respectively by an interval of several months during the war.

Before analyzing these latter findings, it may prove useful to review some conclusions with regard to pelvic architecture and its relation to clinical obstetrics. The shape of the pelvic inlet in early childhood is characteristically elongated anteroposteriorly, or *dolichopellic,* and, if a pelvis of this type were to grow symmetrically, it would have a similar shape in adult life. From this it would appear that the round or flattened forms of the adult pelvic inlet may arise as a result of either of two mechanisms; an excessive growth laterally, that is of the transverse diameter, or a diminished growth anteroposteriorly. From the studies cited above, it seems apparent that the lessening or incomplete development of the anteroposterior diameter is the more important mechanism, increasingly so as the degree of flattening becomes more extreme.

For purposes of classification we may say that the tendency of a pelvis to retain most of the relationships of fetal and childhood conformation, and thus remain relatively elongated anteroposteriorly may be spoken of as dolichopellism (dolicho = long); while the tendency in a pelvis to become broadened transversely and short anteroposteriorly is that toward platypellism (platy = broad or flat). A simple and useful classification of pelves, therefore, can be based upon these anteroposterior and transverse pelvic relationships, as suggested by William Turner in 1885.[6] The relative size of these two dimensions is most conveniently expressed as the pelvic index. This index is the anteroposterior diameter of the pelvic inlet times 100, divided by its maximum

*This study was made possible through grants from the Clinical Research and Teaching Funds of the Yale University School of Medicine.

transverse diameter. By means of this index, it is possible to group together pelves which show the same degree of anteroposterior flattening or elongation, regardless of their absolute size. Turner classified pelves into three types on the basis of their pelvic index. Those with an index of 95 or more he called dolichopellic, those with an index from 90 to 94.9 mesatipellic, and those with an index less than 90 he termed platypellic. For anthropologic purposes, the use of the pelvic index is ideal and would be useful in clinical obstetrics, except that it is a little unwieldy because it cannot always be estimated by simply viewing dimensions.

A simpler and useful device for classifying pelves based upon the principle of the pelvic index follows. In this method pelves are divided into four general groups:

1. *Dolichopellic Type.*—The anteroposterior diameter of the inlet is longer than the transverse.

2. *Mesatipellic Type.*—The anteroposterior and transverse diameters of the inlet are equal or the transverse diameter is no more than 1 cm. longer than the anteroposterior.

3. *Brachypellic Type.*—The transverse diameter is more than 1 cm. and less than 3 cm. longer than the anteroposterior diameter.

4. *Platypellic Type.*—The transverse diameter is 3 cm., or more than the anteroposterior diameter.

We have found this method of pelvic classification clinically useful as a ready means of identifying pelves for purposes of description and record. To complete the survey certain morphologic characteristics, not associated with mensuration, may be added to the pelvic survey, such as the wideness or narrowness of the pelvic forepart, sacrosciatic notch, etc.

From our investigations of adult pelves in both sexes, it appears that at the present time methods of classification based on sex characters may be confusing and, in some instances, not altogether sound. This is in view of the fact that our studies in male pelves show essentially the same variations that we find in the female. Thus, in the investigation of Gruelich and the author[2] we state, "our findings indicate that the pelvic inlet of the male is as variable in shape as that of the female. . . . It is evident, therefore, that there is in our population at least no one type of male pelvis, just as there is no one type of female pelvis." And again, "It is evident from the tracings that the shape of the pelvic inlet of most of the men of our series is quite different from that described in the textbooks as typically masculine. Indeed, the pelvic inlet of some of our males so closely resemble that of some of the student nurses of our earlier series that it would be difficult in certain cases to determine the sex of the individual from the shape of the pelvic inlet alone."

It seems clear that, while certain sex characteristics of male and female pelves can be accepted as more or less constant, others formerly thought to be constant are highly questionable. In addition, "normal" variations in anteroposterior and transverse relationships are apparently present in both sexes in wide distribution. That the anteroposterior and transverse relationships can form a suitable basis for clinical classification has been recently re-emphasized by C. Nicholson,[7] who states: "Obstetricians have of late devoted a great deal,

probably too much attention to the classification of the pelvis by its shape. Accepting the fact that the lengths of the pelvic diameters, in common with other anatomical measurements, are normally distributed, we may from the given

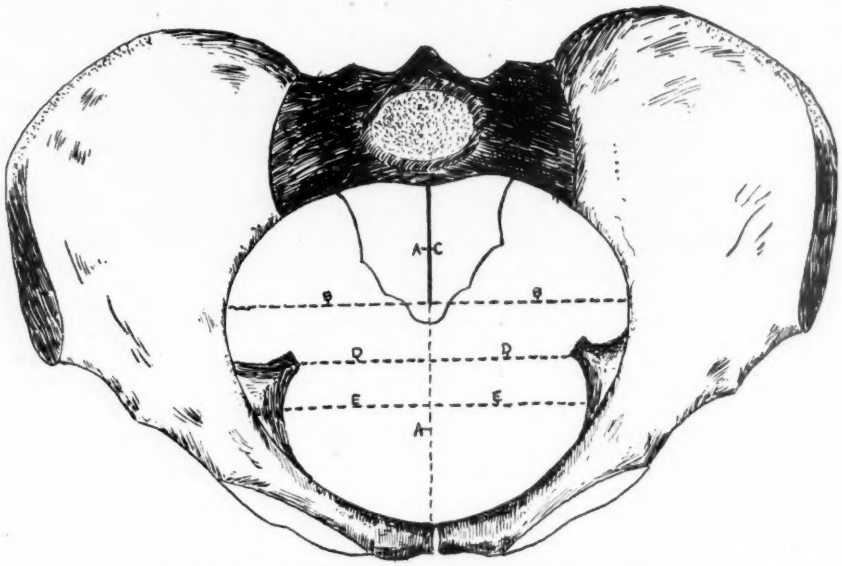

Fig. 1.—The pelvis seen from above. *A*, Anteroposterior diameter of inlet; *B*, transverse diameter of inlet; *C*, posterior sagittal diameter of inlet; *D*, interspinous or transverse diameter of midplane; *E*, widest transverse diameter of outlet.

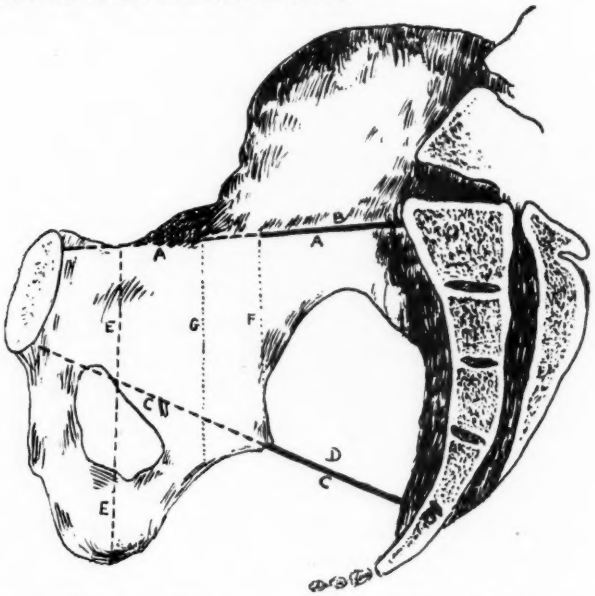

Fig. 2.—Lateral aspect of pelvis. *A*, Anteroposterior diameter of inlet; *B*, posterior sagittal diameter of inlet; *C*, anteroposterior diameter of midplane; *D*, posterior sagittal diameter of midplane.

figures calculate the corresponding figures for the pelvic index which, after all, is the chief guide to the shape of the pelvis.''

The following diameters of the pelvis we have found to be clinically useful and have been used throughout most of the studies referred to here. Figs. 1 and 2.

Pelvic Inlet

Anteroposterior Diameter.—A line drawn from the upper posterior surface of the symphysis to the sacrum at a point where the iliopectineal lines would converge if they were to be extended.

Transverse Diameter.—The widest transverse diameter of the pelvic inlet.

Posterior Sagittal Diameter.—That part of the anteroposterior diameter which lies posterior to its intersection by the transverse diameter.

Pelvic Midplane

Anteroposterior Diameter.—A line drawn from the lower posterior surface of the symphysis pubis posteriorly through the level of the ischial spines to the lower sacrum.

Transverse Diameter.—The shortest diameter between the ischial spines.

Posterior Sagittal Diameter.—That part of the anteroposterior diameter which lies posterior to its intersection by the transverse diameter.

Outlet

Widest Transverse Diameter of the Outlet.—A line drawn between the ischial bones at the base of the ischial spines.

(All of the above are determined roentgenologically.)

The pelvic survey of the outlet also includes the bituberal diameter as determined manually. This is not included in the present and previous studies.

For purposes of evaluating the present study, a summary of the findings on 500 white primigravid women are given[4] in Table I.

TABLE I. TYPE DISTRIBUTION

Dolichopellic type	113	or 22.6 per cent
Mesatipellic type	233	or 46.6 per cent
Brachypellic type	144	or 28.8 per cent
Platypellic type	10	or 2.0 per cent

TABLE II. AVERAGE DIAMETER RANGE IN 500 PELVES OF WHITE WOMEN

	DOLICHOPELLIC	MESATIPELLIC	BRACHYPELLIC
Inlet			
Anteroposterior	12.0 to 13.0	11.5 to 12.25	10.5 to 11.5
Transverse	11.5 to 12.25	12.0 to 12.75	12.25 to 13.25
Posterior sagittal	4.5 to 5.5	4.25 to 5.0	4.0 to 4.5
Midplane			
Anteroposterior	12.0 to 13.0	11.75 to 13.0	11.5 to 12.75
Transverse	9.25 to 10.25	10.0 to 10.75	10.0 to 11.0
Posterior sagittal	4.75 to 5.5	4.5 to 5.5	4.5 to 5.5
Outlet			
Widest transverse	11.3	11.9	12.0

The pelvic type distribution of the present study of 100 primigravid Negro women is shown in Table III.

TABLE III

Dolichopellic type	29	or 29.0 per cent
Mesatipellic type	43	or 43.0 per cent
Brachypellic type	25	or 25.0 per cent
Platypellic type	3	or 3.0 per cent

To those interested in the pelvic index, as described by Turner, in these 100 Negro pelves, Table V shows the distribution.

TABLE IV. AVERAGE DIAMETERS

	DOLICHOPELLIC	MESATIPELLIC	BRACHYPELLIC	PLATYPELLIC
Inlet				
Anteroposterior	12.36	11.28	10.70	9.23
Transverse	11.50	11.79	12.46	12.76
Posterior sagittal	4.50	4.03	4.08	2.33
Midplane				
Anteroposterior	12.54	12.31	12.45	12.16
Transverse	10.09	10.24	10.84	11.50
Posterior sagittal	4.94	4.79	5.00	4.63
Outlet				
Widest transverse	11.38	11.50	12.00	12.40

TABLE V

Less than 90	(Platypellic)	26
90 to 94.9	(Mesatipellic)	21
95 or more	(Dolichopellic)	53

TABLE VI

New England States	38
Middle Atlantic States	4
Southern States	49
Missouri	1
West Indies	7
Portugal	1

TABLE VII

	SPONTANEOUS BIRTH OR LOW FORCEPS	OPERATIVE BIRTH
Dolichopellic type	26	3 (2 forceps for pelvic indication)
Mesatipellic type	39	4 (2 forceps for pelvic indication)
Brachypellic type	22	3 (3 cesarean sections for pelvic indications)
Platypellic type	1	2 (2 cesarean sections for pelvic indications)

Operative Incidence for Pelvic Indications

Dolichopellic	6.8 per cent
Mesatipellic	4.6 per cent
Brachypellic	12.0 per cent
Platypellic	66.6 per cent

Information as to the birthplace of these women was recorded, but no correlation between pelvic type and such geographical distribution was noticed. The range is recorded in Table VI.

As in the previous studies, the clinical course of labor was reviewed according to pelvic type and summarized in Table VII.

The series is too small for definitive clinical evaluation, but the evidence presented bears out findings previously seen in a much larger group of white women; that is, that the round (mesatipellic) or elongated (dolichopellic) pelvis is more favorable for natural birth than the oval (brachypellic) or the flat (platypellic) pelvis.

At first thought it would appear that the increased incidence of the dolichopellic type in these Negro women over the white group might be explained as the result of racial influence; however, a study by Gruelich and the author[8] in 100 white women in a more privileged economical group than the 500 white ward patients cited above showed an even greater tendency toward dolichopellism than the Negro group. These findings are recorded in Table VIII.

TABLE VIII

Dolichopellic type	37.0 per cent
Mesatipellic type	46.0 per cent
Brachypellic type	17.0 per cent
Platypellic type	0.0 per cent

Comment

Variations of the pelvis as they occur in the adult female offer considerable speculation as to etiology. Undoubtedly numerous factors contribute, among which those having to do with nutrition seem to be of prime importance. In 1936 the author discussed the question, "Is the oval or female type pelvis a rachitic manifestation?"[9] pointing out that in the oval, or so-called "female" (brachypellic) type pelvis the iliac portion of the line of terminal length is consistently shortened. The association of relative shortening of this sector with rachitis was emphasized by Breus and Kolisko in 1904.[10] This study concluded with the observation, "From available information concerning pelves in aboriginal people living in climates where rachitis does not occur, it appears evident that the round type pelvis is greatly predominant. Furthermore, it seems apparent that the unusual incidence of the round (mesatipellic) and anthropoid (dolichopellic) types in the women of our population must be explained on grounds other than those based on such influences as race and constitution." In 1939, in "A Study of Pelvic Type"[1] by Greulich, Thoms, and Twaddle, in a comparison of body build with pelvic type, it was stated, "The high incidence of long oval (dolichopellic) and of round (mesatipellic) pelves among the largest women of both groups suggests the possibility that nutritive and other factors which make for the attainment of maximum normal growth tend to prevent that degree of anteroposterior flattening of the pelvis which has come to be regarded as characteristically feminine."

More recently, other observers have emphasized the importance of the role of nutrition in the ultimate shape of the pelvis. Allen's recent (1944) New Zealand study[11] of 214 cases showed 54.2 per cent of dolichopellic pelves (index over 95). He concludes, ". . . that the shape of the pelvis is determined more by environment and diet than by inherited racial tendencies." Nicholson, referred to previously, also states, "The length of the conjugate diameter is very considerably influenced by nutrition, and, in the absence of any large population which up to now can be considered as fully nourished in childhood, it is still quite impossible to determine the mean to which the measurement tends." In summarizing his series of measurements of the adult female pelvis, Nicholson states, "Pelvimetry by radiology in 640 cases is analyzed to show that the length of the conjugate diameter of the female pelvis is very sensitive to nutrition, and the figure quoted in textbooks of anatomy for this diameter is too low."

Conclusion

Evidence has been given which shows that the adult female pelvis in the white and black races is subject to considerable variation and that the tendency for the adult pelvis to maintain its fetal and childhood general relationships is

favorably influenced by nutrition. Clinical experience has shown that pelvic development toward dolichopellism and not toward platypellism is desirable from the obstetric point of view.

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THE VALUE AND LIMITATIONS OF PELVIORADIOGRAPHY IN THE MANAGEMENT OF DYSTOCIA, WITH SPECIAL REFERENCE TO MIDPELVIC CAPACITY

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THE occasional untoward outcome of a pregnancy, resulting from following the radiological criteria in managing a case of dystocia, has led some to discredit the entire procedure of pelvioradiography.

In the great majority of cases, the obstetric prognosis and treatment suggested by the x-ray study of the pelvic measurements and architecture, combined with an evaluation of fetal pelvic relationships, is of great value in the management of dystocia. However, in approximately 2 per cent of the cases in which dystocia is anticipated or appears unexpectedly during labor, the radiological advice given and followed led to an undesirable outcome, and subjects the radiologist or obstetrician reading the films to unfavorable criticism. Usually no allowance is made for any lack of skill or mistakes in clinical judgment on the part of the operator, but the x-ray department is blamed.

In order to determine whether this disparaging attitude is justified, we felt that a comprehensive study of the limitations, as well as the value of pelvioradiography should be made. Our material consists of five hundred consecutive cases referred to the x-ray department because of dystocia, either actual or feared. These cases were studied with particular reference to the evaluation of midpelvic contraction in dystocia.

Roentgen Pelvimetry

A comparison of techniques of roentgen pelvimetry was made by measuring the same patients by various methods. We utilized four well-known methods for each of one hundred patients. The pelvic diameters obtained by the precision stereoscopic method, the Thoms-Torpin isometric scale, and the Snow ruler and Ball nomogram gave results that in all cases were within 0.1 cm. of each other.

We therefore felt that the particular technique used is of less importance than a wide experience in its use. We still use our own combined technique of studying the pelvic architecture by the precision stereoscope, and measuring the diameters with the Snow ruler checked by the isometric scale. A series of measurements on detached and articulated skeletal material showed our results to be accurate to within 0.1 cm. when compared to measurements of the actual material. We are, therefore, convinced that the technique of roentgen pelvimetry used in this study is reliable.

Roentgen Mensuration

It was felt that a study of the actual measurements of the various pelvic planes might be of value in indicating significant dystocia warnings. Most obstetricians are familiar with normal and abnormal inlet measurements, but the significance of contractions at lower levels and the influence of lower sacral variations, side wall convergence, prominent spine, and narrow subpubic angles must be re-evaluated, since these factors can be more accurately measured by roentgen pelvimetry than by the older method of routine external pelvimetry of the outlet. It was obvious from the beginning of the study that, with the elimination of rickets, osteomalacia, and chondrodystrophy from our clinical material, absolute contraction of the pelvic inlet with true conjugates of 7.5 cm. or less were very rarely seen, and most of the cases were relative or borderline pelvic contractions. In an attempt to offer a prognosis in these difficult cases, it was decided that the sum of the anteroposterior and transverse diameters at any given pelvic plane is a more reliable index than the separate consideration of each, because they mutually compensate for each other.

As far as pelvimetry is concerned, this principle of adding the transverse to the anteroposterior diameter is our chief criterion for estimating the prognosis.

A statistical review of pelvic measurements as obtained by our method of radiopelvimetry in correlation with the ultimate mode of delivery reveals the following:

1. Patients who delivered spontaneously or who required simple outlet forceps displayed pelves, the sum of whose true conjugate and transverse diameters of the inlet averaged 24.8 cm.; and the sum of whose interspinous and posterior sagittal diameters of the midpelvis averaged 15.7 centimeters. In addition, it was noted that only rarely did uncomplicated delivery occur from a pelvis, the sum of whose inlet diameters were lower than 22 cm., or from a pelvis, the sum of whose midpelvic diameters were lower than 14.0 centimeters. Below these figures either midforceps or cesarean section was usually performed.

2. Patients requiring midforceps operations displayed pelves, the sum of whose true conjugate and transverse diameters of the inlet averaged 24.4 cm., and the sum of whose interspinous and posterior sagittal diameters of the midpelvis averaged 14.9 centimeters. As might be expected, little difficulty was met during the process of engagement. However, descent of the head below the level of the interspinous diameter became increasingly difficult as the total of the midpelvic diameters decreased. It is to be noted that we used the total of the diameters of the midpelvis (interspinous and posterior sagittal) for prognosticating. Experience has proved that a relatively small interspinous diameter can be readily compensated for by a very ample posterior sagittal diameter. More specifically, we have found that a good prognosis for vaginal delivery could be given for pelves with interspinous diameters from 9 to 9.5 cm., provided the posterior sagittal diameter of the midpelvis is large enough to total 14 cm. or more when added to the interspinous diameter. Limitations, of course, on this general rule are imposed by other complicating conditions, such as malposition of the fetus, large babies, soft tissue dystocia, pelvic anomalies, etc. Delivery from below occurs only rarely with midpelvic dimensions totaling 13.5 cm. or less; and almost never in pelves whose midpelvic dimensions total

less than 13 centimeters. Under the latter conditions only premature and small fetuses can be delivered from below.

3. Patients who required cesarean section displayed pelves, the sum of whose true conjugate and transverse diameters of the inlet averaged 23.3 cm., and the sum of whose interspinous and posterior sagittal diameters of the midpelvis average 15.0 centimeters. These figures illustrate a definite reduction in inlet dimensions, though they exhibit fair to good midpelvic measurements. As might be expected in these cases, the main difficulty occurred during the process of engagement. Failure of the head to engage after a trial of labor usually led to the choice of cesarean section. However, since experience has shown that spontaneous delivery occasionally does occur from below in pelves whose inlet dimensions total from 22 to 24 cm., in such instances a test of labor is advised. Still more rarely is delivery from below seen to occur in pelves whose dimensions total from 20 to 22 cm., hence a short trial of labor to see if engagements will occur is suggested. With measurements below 20 cm., experience has shown that attempts at vaginal delivery of all but a very premature fetus are disastrous. More frequently than not, it has been seen that once engagement occurs in pelves of a borderline inlet, little difficulty is encountered while passing through the midpelvis.

Summary.—If the inlet measurements are below 23 cm. and/or outlet measurements below 14 cm., dystocia is expected. For inlet dystocia the prognosis is guarded or poor, with a section to be considered. For outlet dystocia the prognosis is usually a forceps operation. We do not recommend section for outlet dystocia alone unless it is combined with other unfavorable factors: android pelves, narrow outlet, prominent spines, converging side walls and lateral bore, and malposition, indicating that a forceps operation may be unduly difficult.

Estimation of Midpelvis and Pelvic Outlet

The method of determining midpelvic volume by means of the interspinous measurements alone, as suggested by Ball, has not proved reliable in our hands in any individual case. The basic fault lies in the fact that the actual midpelvis, unlike the inlet, is irregularly circumscribed, and therefore cannot be accurately represented by any one volumetric figure. If the interspinous diameter alone is used to determine outlet volume, results may sometimes be apparently incongruous. For example, in our series there were six cases in which the "outlet volume" was 300 to 400 c.c. smaller than the volume of the head. Although two of these cases came to section, all of the other four delivered normal-sized infants spontaneously or with low forceps. Conversely, there were many cases in which the outlet volume measured greater than the volume of the head, but where midforceps was necessary because of midpelvic arrest.

We feel, therefore, that the present method of determining midpelvic volume by means of the interspinous diameter is inadequate, and may actually be deceiving. In giving a prognosis regarding the midpelvis or outlet, we place much greater emphasis on such factors as lateral bore, side walls, subpubic angle, and sacrosciatic notch. The interspinous diameter is, of course, of greater importance as well; however, we prefer to consider it in relation to the other mid-

pelvic diameter, the postsagittal of the midpelvis. In many cases, a narrow interspinous diameter is compensated for by an over-ample postsagittal diameter, especially if the other factors (lateral bore, side walls, etc.) are adequate. The pelvic outlet is not very important from an obstetric standpoint, if it is not confused with the midpelvis. The diameters concerned in the outlet are the bituberous and posterior sagittal, which are always greater than the corresponding midpelvic measurements.

Cephalometry

We have found that our measurement for the circumference of the head is accurate to within 1.0 cm. when checked with the circumference obtained at birth. Knowing the circumference, we employ the Ball nomogram for determining head volume.

Fetometry.—Attempts were made at predicting the weight of a fetus from the circumference of the head. One-fourth of the cases differed by more than one pound, and therefore were of no value. Since only three-fourths of our cases showed a definite correlation between the size of the head (circumference or volume) and the weight of the baby, we feel that, in any individual case, the judging of weight from volume cannot be relied upon.

The failure of predicting weight on the basis of the x-ray measured circumference of the skull is not due to any fault of roentgen technique. The fallacy lies in the infant itself. Two infants, both with the same size head, can differ from each other by 3 to 4 pounds, because of difference in length, and muscular and fatty development. On one occasion, two infants having the same skull circumference by x-ray weighed 5 and 9 pounds, respectively. The children were then measured in the crib and both found to have the same skull circumference, yet one was almost twice as heavy as the other.

A number of children (200) were measured in the nursery and, while the average weight increased with the increase in skull circumference, the extremes in each group differed from each other to such an extent that in the individual cases the procedure was unreliable because of the overlapping (Table I).

TABLE I.

CIRCUMFERENCE	AVERAGE WEIGHT	LIGHTEST	HEAVIEST
33-34 cm.	6 lb. 2 oz.	5 lb. 5 oz.	7 lb. 13 oz.
34-35 cm.	7 lb.	4 lb. 8 oz.	9 lb. 14 oz.
35-36 cm.	7 lb. 3 oz.	5 lb. 13 oz.	8 lb. 12 oz.
36-37 cm.	8 lb.	7 lb. 10 oz.	10 lb. 12 oz.

Pelvic Architecture

All pelves were classified according to their architectural features into the pelvic types of Caldwell, Moloy, and D'Esopo: gynecoid, android, anthropoid, and platypelloid. The android and platypelloid pelves were frequently given a poor prognosis, and operative delivies were common in these groups. In the absence of disproportion, a favorable prognosis was usually given in the anthropoid and gynecoid types and operative deliveries were infrequent in these cases.

Fetal Pelvic Relationship

Any floating head at term was requested to be x-rayed in the standing position to see if engagement would occur, and it very often did in cases where borderline disproportion existed, thus removing doubt and brightening the prognosis. If the vertex remained floating in the upright position the prognosis was better if it lay over the posterior segment of the inlet than over the symphysis, because we felt that the soft tissues of the pelvis directed the vertex into the pelvic axis more efficiently.

Asynclitism was always noted, and a posterior parietal presentation at the inlet was given a better prognosis than the anterior parietal presentation or Nägele's obliquity. At the midpelvis, an anterior parietal presentation was preferred.

Deflection attitudes of the vertex, such as face, brow, and extended occiputs made the prognosis more guarded. Occipitoposterior positions, except in the anthropoid pelves, were considered unfavorable primary presentations. For the reasons previously given, the Ball volumetric comparison is not relied upon, but the fetal pelvic ratio was decided by studying the stereoscopic pictures of the inlet viewed through the precision stereoscope.

Breech Presentations

In order to evaluate our skill in prognosticating breech presentations, a separate study was made of 50 cases. The determination of cephalopelvic compatability where there is a breech presentation presents a more difficult problem in pelvioradiography. We have at present no accurate way of estimating the dimensions of the high floating head of the fetus. Our major criteria in prognosticating such deliveries have been: (1) pelvic dimensions, (2) pelvic architecture, and (3) fetal attitudes (deflection of the vertex, extended arms, and frank breeches). If the breech is extended, such as a frank breech, or if there are deflection attitudes of the vertex or extended arms, we are more likely to look for difficulty. It is difficult to estimate the size of a breech presentation; very little consideration is given to this factor unless the baby is obviously small and premature. The pelvic architecture is important if an extraction or forceps of the aftercoming head are to be performed. The decision, however, is based almost entirely on the pelvic measurements. A trial of labor in breech presentation is not practicable, and the decision for vaginal delivery or cesarean section is based almost entirely on the consideration of the pelvis. If it is average in size and of suitable architecture we advise vaginal delivery. On the other hand, if it is small or of poor architecture, section is advised. There is no middle ground to be covered by a trial of labor.

There are among our records a series of 50 pelvimetries with the fetus in the breech presentation. Forty-six were given a good prognosis for vaginal delivery. Forty-two of these did terminate with delivery from below with little or no difficulty; four terminated in cesarean section. However, not one of these four required section because of bony dystocia. One section was performed without a trial of labor, and three because of cervical dystocia in elderly pri-

miparas. Cesarean section was advised by us on five other cases, and all five terminated in section. However, whether these could have been delivered from below will remain an unsettled question, since section was performed on all early in labor. Only one case terminated in craniotomy. However, this mother had eclampsia and the fetus died in utero several hours before delivery. The average of the sums of the inlet diameters was 25 cm., and of the midpelvic diameters 15.4 cm., illustrating that breech presentation usually occurs in average-sized pelves.

The Value of Pelvioradiography in Dystocia

A total of 500 cases of suspected dystocia have been studied, and a radiologic prognosis given on the basis of pelvimetry, pelvic architecture, fetal pelvic relationships, and presentation. All cases were classified into one of four prognostic groups: good, fair, guarded, and poor, on the basis of criteria listed in Table II. A good deal of latitude is allowed in estimating the actual prognosis. For instance, a malpresentation, poor pelvic architecture, or asynclitism would induce us to place the prognosis one class below that which the actual pelvic measurements would indicate.

TABLE II. INLET PELVIMETRY AS A BASIS FOR PROGNOSIS

GROUP	PROGNOSIS	ANTERO-POSTERIOR	ANTERO-POSTERIOR PLUS TRANSVERSE	FETAL PELVIC RELATION	TREATMENT	OUTCOME EXPECTED
A	Good	Above 10.5 cm.	24 cm.	No disproportion	Labor	Spontaneous delivery is the rule
B	Fair	10-10.5 cm.	22-24 cm.	Borderline disproportion	Test labor	Vaginal delivery is usual
C	Guarded	9-10 cm.	20-22 cm.	Relative disproportion	Short trial labor	Cesarean section probable
D	Poor	7.5-9.0 cm.	Below 20 cm.	Absolute disproportion	Cesarean section	Cesarean section necessary

Results

Group A.—(good prognosis) consists of those patients with no disproportion and a good prognosis.

Spontaneous delivery is the rule. There were 326 cases, or 65 per cent of the entire series in the group. In other words, almost two-thirds of the patients in whom dystocia was feared, the x-ray indicated a very favorable outcome with vaginal delivery. Considering that low forceps are often elective, it was decided to consider them as nonoperative and to judge all other forceps, operations, cesarean sections, and other vaginal maneuvers as operative. The number of patients that required operative deliveries in Group A was 52, and this amounted to 16 per cent of the group; the remaining 84 per cent delivered either spontaneously or with low forceps.

There were 13 stillbirths, five of which died before delivery. The other eight died of intracranial hemorrhage, sustained during vaginal delivery. If these babies were delivered by section they probably would have survived; therefore we probably were wrong in eight instances in advising vaginal delivery.

The 12 patients sectioned in this group were sectioned for extrapelvic indications: we gave a correct prognosis of 98 per cent.

Group B.—(fair prognosis) includes patients with borderline disproportion and a fair prognosis. A test of labor is usually recommended, and vaginal delivery is the rule. There were 98 cases, or 20 per cent of the entire series, in this group. Operative delivery was necessary in 54 per cent. Midforceps was the most frequent operation, and was performed in almost one-third of the cases. The incidence of operative vaginal deliveries is much higher than in Group A, and a cesarean section had to be performed on 18 per cent of the patients. Cesarean section is often necessary in this group if the baby is over 9 pounds.

There were four stillborns in this group, two of which occurred before labor, and the remaining two during delivery. We achieved a correct prognosis in 98 per cent.

Group C.—(guarded prognosis) includes the group with a guarded prognosis because relative disproportion was evident, and a short trial of labor with early section was advised. Ten per cent of 49 cases were in this group. Forty-two patients, or 86 per cent, required operative deliveries. In 35 cases a cesarean section was performed. There were five stillborns in the 14 vaginal deliveries. One was a spontaneous premature stillbirth. The other four were due to delivery. In all four patients, a cesarean section was considered probable, and was advised after a very short trial of labor. In these four cases the advice was disregarded, and difficult vaginal delivery attempted after long labor. We made the correct prognosis in all of these cases, or 100 per cent.

Group D.—(poor prognosis) consists of those 27 patients, or 5 per cent of the series who had poor prognosis, absolute disproportion, and on whom an elective or immediate section was necessary. In 24 cases, a successful section was performed. In the three cases in which a vaginal delivery was attempted, stillbirths resulted.

In the entire series of 500 cases, a correct prognosis was given in 489 cases, or 97.8 per cent. A favorable prognosis was given in 326 cases, and 247 either delivered spontaneously or by low forceps, many of which were elective or prophylactic. Of the entire series, only 35 per cent required operative delivery; this indicates the conservative effect of pelvioradiography.

The Limitations of Pelvioradiography

In our opinion, pelvioradiography is not as exact a science as geometry. Correct answers cannot always be given to a problem of dystocia from study of the x-ray alone. It is not a panacea for all difficult obstetrics, but it definitely takes its place with the ready availability of blood and plasma, chemotherapy, and improved methods of analgesia and anesthesia as one of the great advances in modern obstetrics. The limitations of value of pelvioradiography can be ascribed to the following conditions:

1. *The Character of the Uterine Contractions of Labor.*—These will be mild and irregular, or painful but ineffectual, and nonphysiologic. Although the dystocia dystrophy syndrome is more common in the android pelvic type, it can occur in any patient.

2. *The Soft Tissue Factor.*—The greatest transverse diameter of the pelvic inlet, as measured in x-ray films, is reduced in the body by the psoas muscles by a variable but unknown amount. In highly muscular women of the short stocky variety, a considerable amount of available inlet space is eliminated by these muscles as they cross the pelvic brim. The estimation of the thickness of these muscles in the living person is impossible, and may lead to serious dystocia in relative disproportion cases. Small vaginas, congenital atresia and septa, and thick perineal muscles may obstruct labor even though the bony passage is ample. Dry labor or constriction ring dystocia may also upset the labor apple cart.

3. *Behavior of the Cervix.*—Some cervices are long, thick, rigid, and do not seem to undergo effacement or dilatation as readily as others, resulting in so-called cervical dystocia.

4. *The Skill of the Obstetrician.*—That poor judgment and lack of skill are occasionally the cause of poor results in cases that were studied by pelvioradiography is obvious. The prognosis given is not adjusted to the ability of the operator, and a certain amount of error is thus admitted.

5. *The Age of the Patient.*—This factor is not considered in giving a radiological prognosis. In arriving at an obstetric prognosis, the physician must take this into consideration.

6. The previous history in multiparas is a reliable guide to obstetric prognosis, yet is not always available to the radiologist.

Mortality

In this series of 500 cases of dystocia there were 25 stillbirths or neonatal deaths, an incidence of 5 per cent. This is slightly above the usual hospital figure, but is not very high for a dystocia series. Six of the babies died of conditions unrelated to delivery. Of the other 19 cases, cesarean section was advised in eight, but this advice was disregarded and difficult vaginal deliveries resulted in stillbirths. The other 11 were advised to have vaginal deliveries, but suffered the same fate. These are our 11 mistakes. There was no maternal mortality in this series.

Summary and Conclusions

1. Provided that a reliable technique of roentgen pelvimetry is used, there is very little difference in the roentgen mensuration.

2. The sum of the anteroposterior and transverse diameters at any given pelvic plane is a more reliable index of pelvic capacity than the separate consideration of each.

3. If the inlet measurements total less than 23 cm. and/or the midpelvic measurements less than 14 cm., dystocia is expected.

4. Cephalometry and fetometry are too inaccurate to be of much importance in pelvioradiography.

5. The fetal-pelvic ratio was arbitrarily decided by the use of the precision stereoscope, and not by volumetric comparisons which were too often misleading.

6. The pelvic architecture played a part in influencing our prognosis. The prognosis becomes progressively worse in the following order; gynecoid, anthropoid, platypelloid, and android.

7. Malposition influenced the prognosis unfavorably.

8. The prognosis in breech presentation is based almost entirely on the pelvic measurements and architecture, and no trial of labor is advised in this presentation. In no case where a vaginal delivery of a breech presentation was advised did such a delivery terminate with fetal mortality.

9. A correct prognosis was given in 97.8 per cent of the series.

10. In only 35 per cent of this series in which dystocia was feared was operative delivery necessary. Sixty-five per cent were given a good prognosis, illustrating the conservative influence of pelvioradiography.

11. The limitations of pelvioradiography are assigned to the difficulty in estimating the soft tissue factors, behavior of the cervix, character of the labor contractions, the skill of the obstetrician, and the age and previous history of the patient.

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HEART DISEASE IN PREGNANCY

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HEART disease long has been recognized as a serious complication of pregnancy. In recent years its increased prominence as a cause of maternal death has resulted, in part, from the improvement in prevention and treatment of other major causes of death, such as hemorrhage, toxemia, and infection. Patients with heart disease complicating pregnancy have always received careful study and treatment in the Woman's Clinic of the New York Hospital in an effort to lessen the immediate, as well as the future damage to the heart. Special attention has been directed to the disease, because its incidence has been found to be greater in the Northeastern States.

A five-year study of 418 patients with cardiac disease was made by Stander and Kuder[1] in 1937, and by Stander[2] in 1938. The present report deals in a similar fashion with the subsequent seven-year period, and embraces 720 additional cases. Thus a total of 1,138 women suffering from heart disease has been treated on the Obstetrical Service during the twelve-year period since Sept. 1, 1932. We have adhered to the New York Heart Association functional classification throughout, and shortly after the beginning of this second study period we adopted the revised classification as proposed by this association.

The 720 cases analyzed in the present study represent 3.02 per cent of the 23,858 pregnancies cared for during the period from September 1, 1937, through December 31, 1944. This incidence shows but a slight increase from that of 2.97 per cent in the previous five years. In the present series 425 of the patients were primiparas and 295 were multiparas.

TABLE I. FUNCTIONAL CLASSIFICATION OF CARDIAC DISEASE

TYPE	CASES	PER CENT OF TOTAL
Class I	227	38.48
Class II	322	44.72
Class III	77	10.69
Class IV	11	1.53
Unclassified	33	4.58
Total	720	100.00

We have been able to classify, according to the functional level, all but 33 of our cases. Table I presents the distribution of all the cases in the various groups. A few of our records bear the terminology of the old classification. In such instances, for the purposes of uniformity of analysis, they have been considered according to the newer adaptation: Class II-A being equal to Class II; Class II-B becoming Class III; and Class III becoming Class IV. In all cases

we have tabulated the classification recorded at the time of delivery or interruption of the pregnancy. In some instances this was different from that recorded at the initial visit, due to the progress of the disease.

A classification as to etiologic types has been carried out. In Fig. 1, the rheumatic group of 656 cases is shown to represent 91.15 per cent of the total. Of these, 259 were in Class I, 295 in Class II, 76 in Class III, 10 in Class IV, and 16 unclassified. Congenital heart disease in 31 cases accounted for 4.31 per cent, and in this group, except for six unclassified cases, 13 were in Class I, and 12 in Class II. Hypertensive disease was found to be the basis for cardiac trouble in 16 patients or 2.22 per cent; 13 of these were considered as Class II,

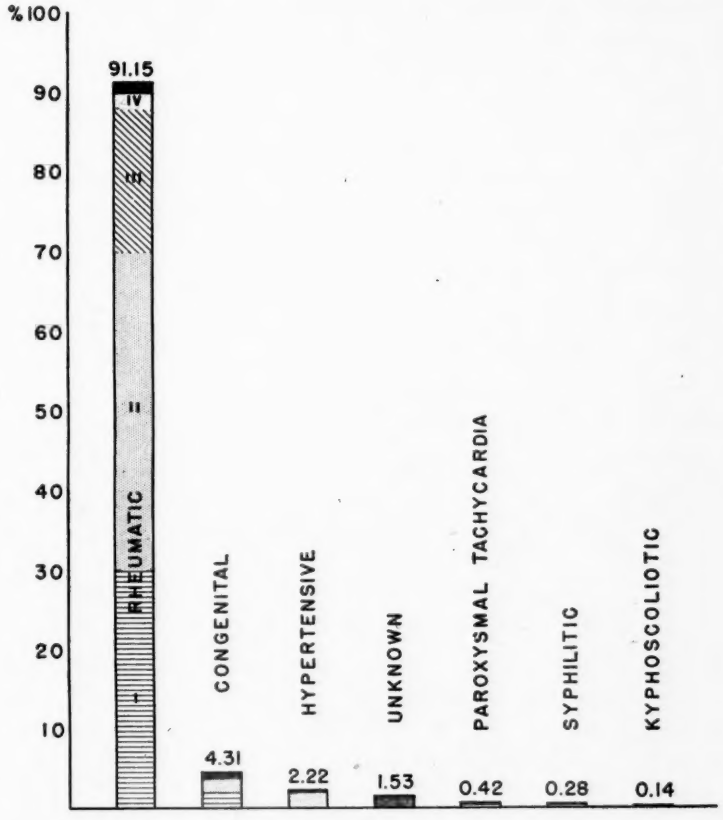

Fig. 1.—Etiologic distribution of heart disease in 720 cases.

one as Class IV, and two unclassified. The type of heart disease was unknown and unclassified in a group of 11 cases, 1.53 per cent. There were three cases, 0.42 per cent, of unexplainable paroxysmal tachycardia; these were not functionally listed, but were presumably Class I. Syphilitic heart disease occurred in two patients, 0.28 per cent; one was in Class I and the other in Class II. Lastly, heart disease was found in association with kyphoscoliosis in three pregnant women, but in only one, Class I, was there found to be an etiologic relation.

Table II presents various diseases that occurred in the past history of our cardiac patients. A history of rheumatic fever in one or more of its manifestations was noted in almost 60 per cent of the entire series, and two of these pa-

TABLE II. PREVIOUS DISEASES

	NUMBER OF CASES	PER CENT OF TOTAL
Rheumatism	311	43.20
Chorea	45	6.24
Rheumatism and chorea	43	5.97
Rheumatism, chorea, and scarlet fever	4	0.56
Scarlet fever	7	0.97
Chorea and scarlet fever	9	1.23
Frequent sore throats	6	0.83
Rheumatic fever, chorea, and scarlet fever	4	0.56
Rheumatic fever and scarlet fever	3	0.42
Diphtheria	3	0.42
Syphilis	2	0.28
Nephritis	2	0.28
Chorea and sore throats	2	0.28
Pott's disease	1	0.14
Nephritis and scarlet fever	1	0.14
Rheumatism and erythema nodosum	1	0.14
Frequent epistaxis	1	0.14
Negative past history	275	38.20
Total	720	100.00

tients had reactivation during their pregnancies. This high incidence emphasizes the importance of obtaining a careful history from each patient.

As would be expected from the preponderance of rheumatic heart disease in our study, mitral lesions accounted for 78.47 per cent of all valvular lesions, and, combined with other lesions, mitral involvement occurred in approximately nine out of every ten cases. In Table III are listed the distribution of the various heart lesions and combinations found in the present analysis.

TABLE III. DISTRIBUTION OF VALVULAR LESIONS

	NUMBER OF CASES	PER CENT OF TOTAL
Mitral stenosis and insufficiency	445	61.81
Mitral stenosis	72	10.00
Mitral insufficiency	48	6.66
Mitral stenosis and insufficiency and aortic insufficiency	48	6.66
Mitral stenosis and insufficiency and aortic stenosis and insufficiency	27	3.75
Aortic stenosis and insufficiency	5	0.69
Aortic insufficiency	3	0.42
Aortic stenosis	1	0.14
Mitral insufficiency and aortic stenosis	1	0.14
Mitral insufficiency and aortic stenosis and insufficiency	2	0.28
Mitral stenosis and aortic insufficiency	3	0.42
Pulmonary stenosis	6	0.83
Congenital lesion	22	3.06
Chronic valvular (hypertensive)	15	2.08
Coronary disease	3	0.42
Paroxysmal tachycardia	6	0.83
Ventricular premature contractions	1	0.14
Unknown	12	1.67
Total	720	100.00

It is a common impression that labor in cardiac patients is of shorter duration than that in noncardiac patients. An analysis of our figures does not entirely bear out this belief. The average length of labor in 260 primiparas with heart disease was found to be $20^{26}/_{60}$ hours, and in 332 multiparas $8^{47}/_{60}$ hours, as compared with the normal given by Stander[3] as eighteen and twelve hours, respectively. Moreover, no appreciable difference was noted in the length of labor among the various cardiac classes.

Treatment

Our treatment of the woman whose pregnancy is complicated by heart disease is based on the patient's cardiac history, the functional capacity of the heart, and, to a lesser degree, the type of cardiac involvement. We believe that emphasis on the particular valvular lesion is not justified, and agree with Hamilton and Thompson[4] that "prognosis in pregnancy is only slightly affected by differences in the valves involved." However, the history of, or the presence of, cardiac decompensation or auricular fibrillation is of great significance, and may be a legitimate indication for the interruption of the present pregnancy and prevention of future pregnancies.

It is our practice to evaluate each patient when first seen, and in the more advanced cases this requires hospital study. Those patients who may safely be allowed to continue their pregnancies are followed at frequent intervals in a special Cardiac Clinic maintained in the Lying-In Hospital. Certain other patients with more serious heart disease may be kept in the hospital throughout the remainder of their pregnancies.

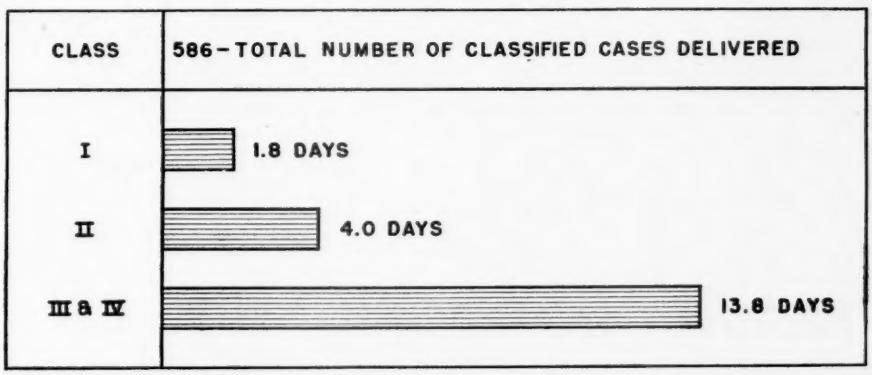

Fig. 2.—Average duration of hospitalization prior to delivery.

We are convinced that hospitalization prior to delivery is an important factor in obtaining a low mortality rate in cardiac patients. Consequently, it is our rule to admit prior to labor all patients in Classes III and IV, and selected patients in Classes I and II. The average duration of predelivery hospitalization is shown in Fig. 2. Classes III and IV have been combined because of the small number of cases in Class IV.

A summary of our treatment of patients with heart disease is presented in Table IV. Of the 712 patients, 14.18 per cent terminated as abortions, of which 8.29 per cent were operative and performed because of cardiac indications. This latter figure is in sharp contrast to the 2.87 per cent incidence of therapeutic abortion in the previous five-year period. Among the full-term and premature deliveries 29.08 per cent were operative, a figure practically identical to that of the former study. The incidence of forceps deliveries, 18.13 per cent, shows an increase in the use of this procedure when compared with 11.96 per cent in the former study. This is partially compensated by a reduction in the incidence of cesarean sections, from 4.07 per cent to 1.55 per cent. The wisdom of such a trend has been well proved in a recent paper by Mendelson.[5]

TABLE IV. TREATMENT OF CARDIAC DISEASE IN 712 PATIENTS

	TOTAL CASES	INCIDENCE	INDICATIONS			
			CARDIAC		OTHER	
			CASES	INCIDENCE	CASES	INCIDENCE
Abortions.—						
Spontaneous	27	3.78				
Operative	74	10.40	59	8.29	15	2.11
Miniature cesarean section	15	2.11	15	2.11	0	0
Completion incomplete abortion	11	1.55	0	0	11	1.55
Therapeutic curettage	44	6.18	44	6.18	0	0
Salpingectomy (ectopic)	3	0.42	0	0	3	0.42
Hysterectomy	1	0.14	0	0	1	0.14
Total	101	14.18	59	8.29	15	2.11
Deliveries.—						
Spontaneous	404	56.74				
Operative	207	29.08	140	19.68	69	9.69
Low forceps	141	19.81	117	16.44	24	3.37
Midforceps	21	2.95	12	1.69	9	1.27
Cesarean section	21	2.95	11	1.55	10	1.40
Breech extraction	18	2.53	0	0	18	2.53
Manual removal of placenta	6	0.84	0	0	6	0.84
Version and extraction	1	0.14	0	0	1	0.14
Craniotomy	1	0.14	0	0	1	0.14
Total	611	85.82	140	19.68	69	9.69
Grand Total	712	100.00	199	27.97	84	11.80

TABLE V. INCIDENCE OF OPERATIVE DELIVERIES

CLASS	NUMBER OF DELIVERIES	OPERATIVE DELIVERIES	
		NUMBER	INCIDENCE
I	256	62	24.21
II	282	96	34.02
III and IV	44	31	70.43
Total	582	189	32.48

It is well to note that 9.67 per cent of the group had operative deliveries for indications other than cardiac disease. In certain additional instances, while cardiac indications were given, other factors existed which influenced the type of procedure employed.

The percentage of operative deliveries according to functional classification is given in Table V. Even though an approximate 10 per cent be subtracted from each group as having been performed for indications other than cardiac disease, it is apparent that three times as many operative deliveries were performed for cardiac reasons in Classes III and IV as in Class I. The teaching of this clinic, as illustrated by the incidence of operative deliveries in Class I, is that added work of the heart in the second stage of labor can be spared by early and judicious operative means. We further recommend that operative deliveries of cardiac patients be carried out under local anesthesia such as outlined by Griffin and Benson.[6]

The cardiac patient in labor requires continued vigilance, and particular attention must be given to the pulse and respiration rate as pointed out by Mendelson and Pardee.[7] All patients who, in the first stage of labor, have an elevation in pulse rate above 110 or respiratory rate above 24 are digitalized, if this has not already been effected. Administration of oxygen by mask or tent, and other supportive measures, such as Fowler's position, are given when there are symptoms or findings of impending failure.

Mortality

Maternal mortality due to heart disease is important, as shown by its present-day position among the major causes of maternal deaths. On the basis of this seven-year study, heart disease was found to be the leading cause of maternal deaths at the Lying-In Hospital (24.33 per cent). Such a prime position does not result from an increasing frequency of heart disease, or from a rise in mortality among our cardiac patients. Its change from a former third position may be said to be due to greater success in our efforts to control and combat infections and hemorrhage. In the treatment of infections marked improvements have resulted since the advent of sulfonamide chemotherapy and penicillin.

TABLE VI. HEART DISEASE IN 37,913 PREGNANCIES

	1932-1937			1937-1944			TOTAL		
	TOTAL CLINIC	CASES	INCIDENCE	TOTAL CLINIC	CASES	INCIDENCE	TOTAL CLINIC	CASES	INCIDENCE
Deliveries	13,140	386	2.86	22,022	611	2.78	35,162	977	2.84
Abortions	915	32	3.49	1,836	101	5.50	2,751	133	4.84
Maternal deaths	45	7	15.55	37	9	24.33	82	16	19.51
Undelivered	9	5	55.55	6	5	83.33	15	10	66.66
Delivered	36	2	5.55	31	4	12.90	67	6	8.95

Table VI compares the patients who have heart disease with the total clinic population for both the five- and seven-year periods, and the total twelve-year period. In each of the periods the ratio of the cardiac to the total clinic deliveries was about the same, and for the twelve-year period averaged 2.84 per cent. The incidence of abortions in cardiac patients was found to be 3.49 per cent in the first five years, and 5.50 per cent in the present seven years, with a twelve-year average of 4.84 per cent. This marked rise is explained by an increased number of therapeutic abortions. In the twelve-year total period 19.51 per cent of the total deaths were due to heart disease, 66.66 per cent of these were undelivered, and 8.95 per cent delivered.

TABLE VII. MATERNAL MORTALITY

	DEATHS	DELIVERIES	PREGNANCIES	DEATHS: NUMBER PER 1000 DELIVERIES	DEATHS: NUMBER PER 1000 PREGNANCIES
1932-1937					
Total Clinic	45	13,140	14,055	3.43	3.20
Cardiac	7	386	493	18.22	14.18
1937-1944					
Total Clinic	37	22,022	23,858	1.68	1.55
Cardiac	9	611	712	14.73	12.64
Total 1932-1944					
Total Clinic	82	35,162	37,913	2.33	2.16
Cardiac	16	997	1,205	16.05	13.28

Evidence of improvement in management and treatment of pregnant women can be obtained from comparative studies in mortality rates, as shown in Table VII. This table reveals a halving in the mortality rate of the total clinic population in the present period as compared with the previous period. Among the patients with heart disease there has also been a significant reduction from 14.18 to 12.64 deaths per thousand pregnant cardiac patients.

Of further interest and importance in the maternal mortality is the significance of the unregistered patient. Five deaths occurred in the unregistered group of 65 patients, seven times that in the registered group of seven in 655 patients. In Fig. 3 we have graphically shown these findings.

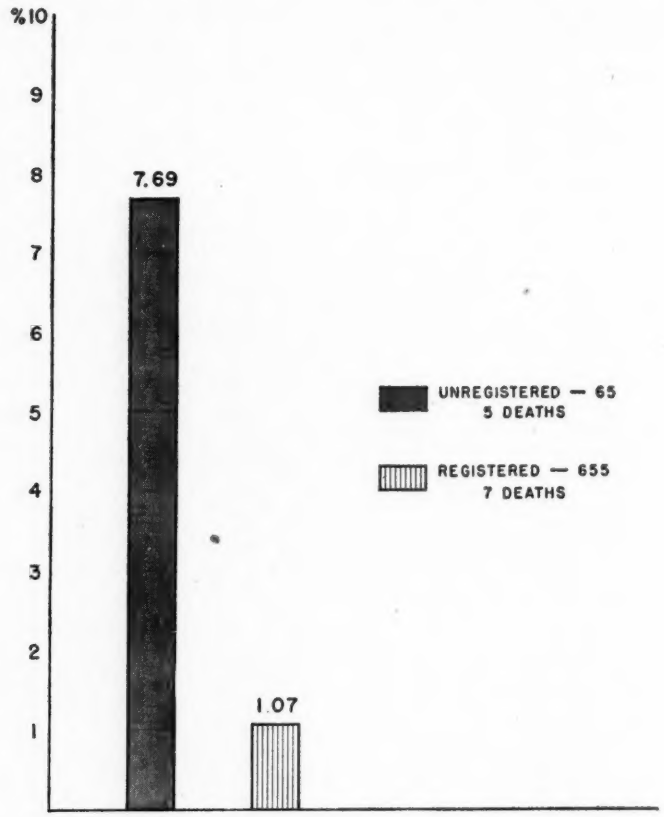

Fig. 3.—Maternal mortality in registered and unregistered patients.

From a review of the nine cardiac deaths listed in Table VIII, it is apparent that death may occur at any time during the pregnancy. The cause of death in six cases was congestive heart failure. One-half of these had preceding upper respiratory infections, a finding reflecting the serious danger of such complications in cardiac patients as previously shown by Oppel.[8] Bacterial endocarditis was the cause of death in two, and coronary occlusion in one other case. Because of the potential hazard of bacterial endocarditis, the prophylactic use of sulfadiazine and penicillin has been advised. Wheeler[9] in a report, not yet published, of 200 cases of subacute bacterial endocarditis found labor as a predisposing factor to death in nine patients, second in importance only to upper respiratory infections.

The infantile mortality among those infants weighing 1,500 grams or over at birth, and including all infants dying during the first fourteen days following birth, was 3.24 per cent. The total clinic figure for the same period was 3.07 per cent. While there is some difference between these two figures, in no instance of the 20 infant deaths reviewed did the maternal cardiac disease seem

TABLE VIII. CARDIAC MATERNAL DEATHS

NO.	AGE	PARITY	LESION	CLASS	REGISTERED	CAUSE OF DEATH
1	26	0	Mitral insufficiency	I	-	Bacterial endocarditis and thrombosis of superior sagittal sinus at 9 weeks. Patient undelivered
2	36	1	Mitral stenosis and insufficiency	II(?)	+	Congestive failure following miniature cesarean section at 15 weeks
3	23	0	Mitral stenosis and insufficiency	II	+	Subacute bacterial endocarditis (Streptococcus viridans). Death 16 days postpartum
4	32	2	Mitral stenosis and insufficiency; auricular fibrillation	IV	-	Congestive failure preceded by bronchopneumonia. Death followed miniature cesarean section at 22 weeks
5	36	1	Mitral stenosis and insufficiency	IV	+	Congestive failure preceded by upper respiratory infection. Death followed at 24 weeks, patient undelivered
6	31	1	Mitral stenosis and insufficiency; aortic stenosis and insufficiency	IV	-	Congestive failure at 32 weeks. Patient undelivered
7	34	2	Mitral stenosis and insufficiency; auricular fibrillation	IV	-	Congestive failure following dilatation and curettage at 13 weeks
8	21	0	Mitral stenosis and insufficiency	IV	+	Congestive failure following bronchopneumonia. Death at 30 weeks, patient undelivered
9	35	3	Coronary sclerosis	Unclassified	+	Coronary occlusion. Death at 39 weeks. Patient undelivered

to play a role. In the previous study by Stander, it was his conclusion that maternal heart disease does not increase the infantile mortality. The same impression is gained from this study.

Summary

Heart disease is a most serious complication of pregnancy. In the 37,913 obstetric patients seen in this clinic in the past twelve years there have been 1,138 with heart disease, an incidence of 3 per cent. As in the past, we have found the functional classification of the New York Heart Association adaptable to the care and evaluation of our patients. Data has been tabulated regarding functional classification, etiologic types of heart disease, previous diseases, and distribution of valvular lesions.

In treating cardiac patients we again emphasize the importance of hospitalization prior to labor. Special care must be given to these women in labor, and the figures bear out our recommendation that the second stage be shortened by operative means, particularly in the severe cardiac. We have noted a trend from cesarean to forceps deliveries, a greater use of local anesthesia, and an evident liberalization in interruption of pregnancies in bad risk cardiacs. These factors explain a lowering of the maternal mortality among cardiac patients from 14.18 to 12.64 per thousand pregnancies. A further lowering of this figure is possible through better cooperation in early registration, and also presumably through improvement in selection of patients for therapeutic abortion, earlier interruption, and judicious sterilization. Perhaps also an improvement will

result from the use of chemotherapy of cardiac patients with respiratory infection and in cardiac patients in labor. The infantile mortality appears unaffected by the maternal heart disease.

Conclusions

1. Heart disease occurred in 3 per cent of our obstetric patients. Seven hundred and twenty cases were analyzed in the present seven-year study and compared with 418 in the previous five years.

2. According to the New York Heart Association functional classification, 38.48 per cent occurred in Class I, 44.72 per cent in Class II, 10.69 per cent in Class III, and 1.53 per cent in Class IV.

3. Rheumatic heart disease accounted for 91.11 per cent of the total cases of heart disease.

4. History of previous disease was given in 61.80 per cent of the total cases of heart disease. Rheumatic fever in one or more of its manifestations occurred in all but 2.43 per cent.

5. Mitral valvular disease is by far the most common type, but we are not convinced that it is more dangerous than other valvular lesions.

6. Good treatment rests on proper study and evaluation of each patient. Hospitalization prior to labor is of benefit, particularly in severe cardiacs. The greatest dangers are auricular fibrillation and history of decompensation.

7. Therapeutic abortions were performed in greater number in the present seven years, 8.29 per cent, than in the previous five years, 2.87 per cent.

8. Operative deliveries occurred in 29.08 per cent. A greater number of forceps deliveries are now performed, and a smaller number of cesarean sections.

9. Heart disease is the leading cause of maternal deaths in the present seven-year period.

10. Compared with the previous five years the maternal mortality in cardiac patients has been reduced from 14.18 to 12.64 per thousand cardiac patients.

11. The mortality in the unregistered group is seven times that in the registered group.

12. The infantile mortality is essentially unaffected by the maternal heart disease.

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VERATRUM VIRIDE IN THE TREATMENT OF THE TOXEMIAS OF PREGNANCY

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ALTERATIONS in the routine for the treatment of any disease follow increased knowledge concerning the malady. In obstetrics, as in all the other specialties, however, old methods of therapy discarded by our predecessors are periodically "discovered" and advanced as the answer to some particular poorly understood problem. Such is the history of *veratrum viride* in the treatment of eclampsia.

Baker[1] who appears to have been one of the first to apply the drug in the treatment of eclampsia (1859) was prompted to publish his experiences with its use by an article which stated that "*veratrum viride* has seen its day." In a discussion of various remedies which might be utilized to control eclampsia, Winter[2] stated concerning *veratrum viride*" . . . in the onward march of medical science it seems to have been lost sight of until comparatively recently, when writers seem to vie with each other in extolling its virtues. . . ." For several years after this the drug was extensively used but again it gradually was discarded in favor of newer methods. Bryant,[3] in 1935, and Bryant and Fleming,[4] in 1940, again urged its use as an adjunct to the treatment of eclampsia, principally because of its vasodilating properties, thus initiating new surge of interest in its application to this condition.

The results obtained from the administration of *veratrum viride* to toxemia patients over a period of eighty-five years are, at least on the surface, good. It must be remembered, however, that for much of this time diagnosis was inexact and many of the cases of "eclamptic convulsions" were from other causes, i.e., epilepsy, nephritis, hypertensive encephalopathy, etc. Likewise, as Zinke[5] so aptly pointed out, the course of eclampsia may vary in different individuals. He described three types: (1) *malignant,* which is fatal from the beginning despite adequate treatment; (2) *benign,* from which the patient will recover regardless of what is done for (or to) her; and (3) those cases of *mean gravity,* which are influenced by judicious treatment. Ryder[6] also was aware of variations in the course of the disease, dependent upon circumstances other than the treatment. He noted in his series of 37 cases, all treated by much the same method, that the death rate varied with the seasons of the year: of 14 women treated in the fall, two died; of eight treated in the late spring, one died; while of 15 treated during the winter, eight failed to survive.

From a review of the numerous papers written on the treatment of eclampsia with *veratrum viride* since the middle of the last century, it becomes obvious that opinion concerning its efficacy is divided. While certain men were enthusiastic, many more considered the drug to be of little or no value. The final results are clouded by the fact that in most instances other drugs (morphine, chloral hydrate, bromides, chloroform) were usually used in conjunction with veratrum, and because the writers did not attempt to classify the cases either as to severity or relationship to delivery (Table I).

TABLE I. RESULTS OF TREATMENT OF ECLAMPSIA WITH VERATRUM VIRIDE

AUTHOR	NUMBER OF CASES	VERATRUM VIRIDE ONLY	VERATRUM VIRIDE PLUS OTHER DRUGS AND/OR INDUCTION	RECOVERED	DIED	PER CENT MORTALITY
Baker, 1859[1]	1		1	1	0	0
Fearn, 1871[24]	13	3		3	0	0
			10	9	1	10
Jewett, 1887[16]	22	22		16	6	27
Trimble, 1890[25]	26	15		14	1	6.7
			11	9	2	18
Ryder, 1906[6]	13			10	3	23
Gillespie, 1911[27]	18	18		14	4	22
Zinke, 1913[26]	30		30			13.3
Haultaine, 1916[28]	38			36	2	5.3
Stevens, 1922[21]	25		25	21	4	16
Bryant, 1935[3]	121		121	109	12	9.9
Bryant-Fleming, 1940[4]	120		120	118	2	1.7

Among those opposed to the use of the drug was Potter,[7] who stated that it was ". . . dangerous, deceptive, and uncertain in its action. It is but a symptomatic remedy at best. . . . It reduces arterial tension and cardiac pressure without exercising special influence over the progress of the malady. . . . I am afraid that many cases of eclampsia have succumbed to the indiscreet employment of *Veratrum*. . . ." Kemper,[8] in discussing a paper in 1899, stated that *veratrum viride* was unsatisfactory, and that any case which could be controlled by any medication would yield to chloral and chloroform.

Impressed by the results of the treatment of eclampsia reported by Bryant and Fleming, the author initiated a series of physiologic and clinical studies in an attempt to localize more accurately the site of action of the drug, and to evaluate its use in the treatment of the hypertensive toxemias of pregnancy. The results of the initial phases of the investigation have been reported previously.[9-11] In this paper the results of the treatment of a group of patients with hypertensive toxemias of pregnancy by *veratrum viride* alone will be reported.

Material

A total of 12 patients was studied. The duration of pregnancy in nine patients not in labor varied between thirty-two and thirty-seven weeks; eight were primigravidas, and all except one had pre-eclampsia. The remaining three were in labor and, of these, one had chronic hypertensive disease with an associated pregnancy. The latter had had an abruptio placenta with a previous pregnancy and, during the prenatal period of this pregnancy, slight elevations in blood pressure had been noted on several occasions.

Method

Prenatal Patients.—All had been confined to bed for at least twenty-four hours prior to the administration of the drug. No medication was given, but all were receiving a salt-poor diet (less than 2 Gm. of NaCl daily). Control periods during which blood pressure, pulse rate, and half-hourly urine output were observed varied from four to twenty-four hours. In each instance the fluid intake was sufficient to maintain an adequate output of urine by a normally functioning kidney. The drug, veratrone (an aqueous solution of *veratrum viride* prepared by Parke, Davis & Co.), was injected intramuscularly at the end

of the control period, usually in a dosage of 0.5 c.c. Subsequent injections were of 0.25 to 0.5 c.c., and were given as indicated by a rise in blood pressure.

Patients in Labor.—The three patients in labor had been observed for three to ten hours prior to the injection of the drug. During this time frequent recordings of blood pressure and pulse rate were made, and the urine output and fluid intake were measured. The initial injection of veratrone was 0.5 c.c., and subsequent injections varied from 0.25 to 0.5 c.c. The records of fluid intake and output, blood pressure, and pulse rate were continued.

The observations in both groups were continued for periods varying from six to twenty-two hours, at which time the experiment was terminated. Only three patients were studied for less than ten hours, two of these for nine hours, and one for 6 hours; in each instance the drug was discontinued because of a markedly decreased urinary output. All urine specimens were collected by catheter, the bladder being completely emptied each time.

Results

Blood Pressure.—In the prenatal patients the blood pressures were substantially reduced in each instance (Table II). The pressure was kept below the preinjection level for periods varying from six to twenty-two hours, at the end of which time the observations were terminated. As has been reported previously[11] the drop in blood pressure was easy to obtain in those patients with pre-eclampsia. An initial effect often was noted within ten to fifteen minutes of the injection, with the lowest level following in about one hundred and twenty minutes. Shortly after the most marked depression, the systolic blood pressure usually rose 10 to 30 mm. Hg, where it became temporarily stabilized. As the effect of the drug diminished, the blood pressure gradually increased, but repeat injection usually resulted in a secondary fall.

The reduction of blood pressure was somewhat less striking in those patients who were in labor (Table II). In one (Case 11), the pressure increased despite the fact that the pulse rate was depressed.

Pulse Rate.—The highest average pulse rate following administration of the drug in the prenatal patients was 73 beats per minute. The lowest pulse rate recorded was 44 beats per minute. As reported previously, the pulse in most instances returned to the preinjection rate before a marked rise in blood pressure was noted.

The pulse rate remained higher in the patients in labor than in the prenatal cases. The reduction in this group was most marked in a patient with pre-eclampsia (Case 10).

Urine Volume.—In all the patients not in labor, the injection of the drug was followed by a reduction in urine volume. In two instances this reduction was slight (Cases 1 and 9); in four patients, however, urine output reached a dangerously low level. One (Case 8) produced 55 c.c. in eight hours (three hours anuria); Case 5 produced 62 c.c. in four hours (three hours anuria); Case 6 produced 81 c.c. in six hours (two hours anuria); and Case 7 produced 75 c.c. in nine hours (six hours anuria) (Fig. 1). A comparison of control 24-hour urine volumes with those while the drug was being given is shown in Fig. 2. During the entire period in which the blood pressure was kept below its usual level by the drug, the urine output was diminished as compared to that of the control day. As the blood pressure rose however, there occurred an increase in urine volume to compensate for the delayed excretion. The total for the 24-hour test period was substantially the same as that during the control day, since the diuresis was not sustained. Essentially the same results were noted in other patients studied in an identical manner. However, in two instances the total daily output was definitely diminished as a result of administration of Veratrone (Table III).

TABLE II

CASE	NUMBER	AGE YEARS	PARA GRAVIDA	DURATION PREGNANCY WEEKS	AVERAGE CONTROL BLOOD PRESSURE MM. HG.	AVERAGE URINE VOLUME (C.C. PER ½ HOUR) CONTROL	AVERAGE URINE VOLUME (C.C. PER ½ HOUR) AFTER INJECTION	AVERAGE BLOOD PRESSURE AFTER INJECTION	LOWEST BLOOD PRESSURE	AVERAGE PULSE RATE AFTER INJECTION	UREA CLEARANCE (C.C. PER MIN.) CONTROL	UREA CLEARANCE (C.C. PER MIN.) AFTER INJECTION
Prenatal												
(1)	315856	29	0/i	34	165/110	69.0	67.0	120/90	110/85	64	41	32.0
(2)	334292	29	0/i	34	165/110	30.0	16.2	130/85	110/75	58		
(3)	332897	26	0/i	36	150/110	31.6	23.6	115/85	100/80	70		
(4)	329832	19	0/i	36	150/110	88.6	59.0	120/80	100/70	50		
(5)	318412	18	0/i	36	170/120	63.6	19.5	130/85	100/60		26	9.8
(6)	302266	25	0/i	37	168/120	25.0	6.5	130/86	100/70	60	45	29.0
(7)	324495	23	0/i	32	190/120	7.5	3.4	140/95	120/70	58		
(8)	353540	23	0/i	37	180/130	103.0	72.0	110/70	80/40	60	83	27.0
(9)	329896	39	v/vi	8	180/120	55.1	51.4	140/95	90/60	73		
Patients in Labor												
(10)	355548		0/i	40	150/100	18.2	18.8	135/90	100/80	58		
(11)	340876		0/i	36	170/115	21.0	20.0	180/120	175/120	75		
(12)	355241		i/ii	40	150/100	33.3	2.6	130/85	110/70	79		

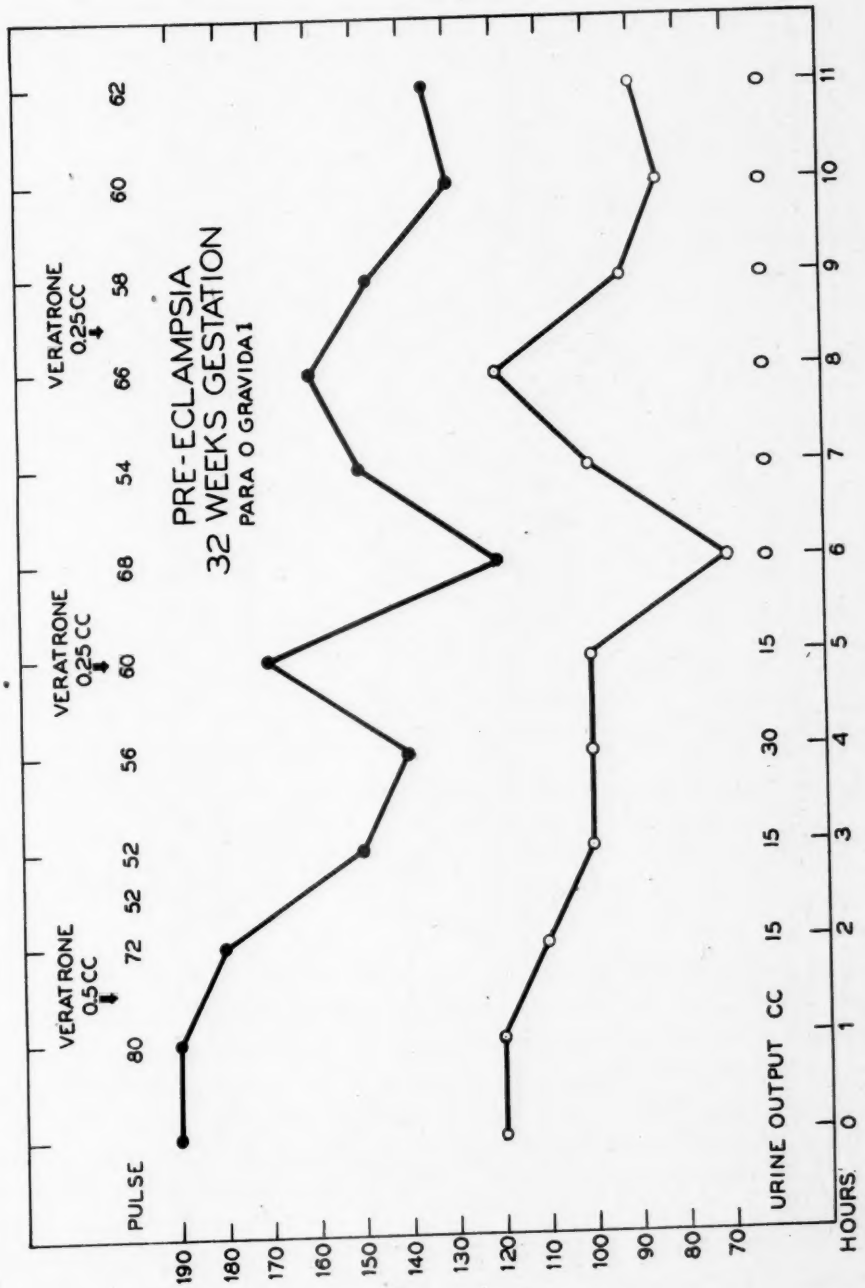
PRE-ECLAMPSIA
32 WEEKS GESTATION
PARA 0 GRAVIDA 1
VERATRONE 0.5CC
VERATRONE 0.25CC
VERATRONE 0.25CC
PULSE
URINE OUTPUT CC
HOURS

Fig. 1.

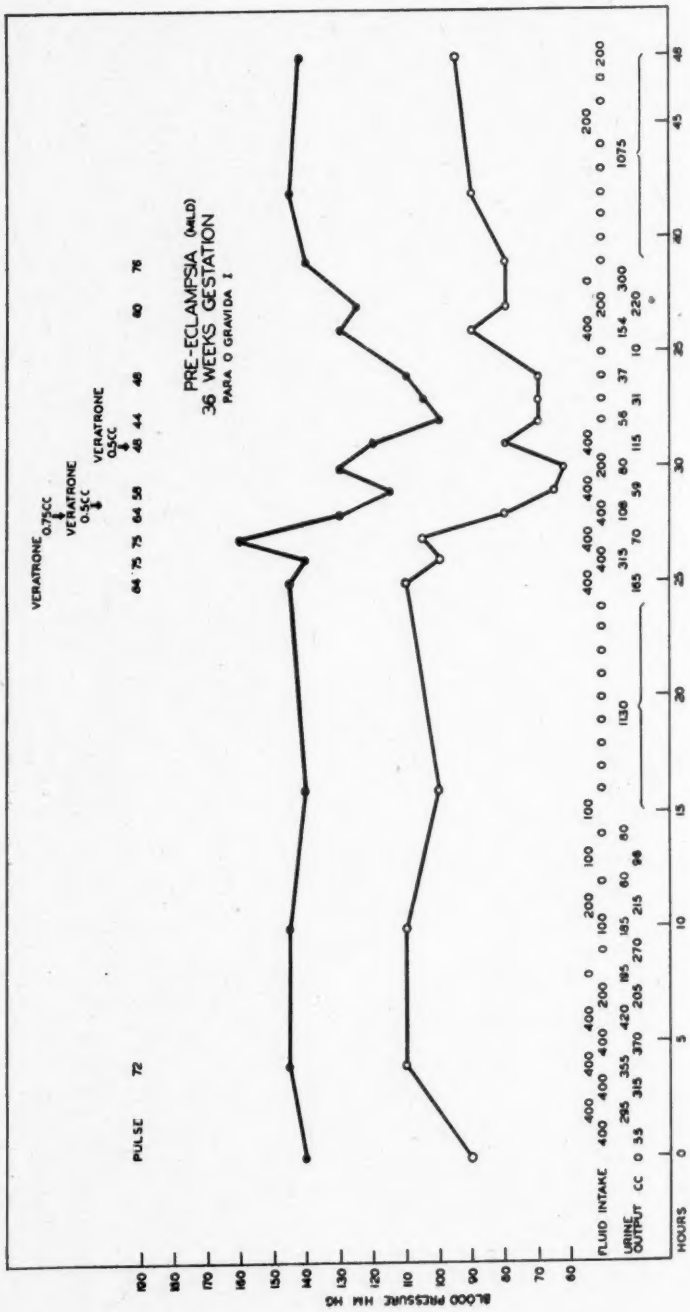
PRE-ECLAMPSIA (MILD)
36 WEEKS GESTATION
PARA 0 GRAVIDA 1
VERATRONE 0.75CC
VERATRONE 0.5CC
VERATRONE 0.5CC
PULSE
BLOOD PRESSURE MM HG
FLUID INTAKE
URINE OUTPUT CC
HOURS

Fig. 2.

TABLE III. 24-HOUR URINE VOLUMES IN PRE-ECLAMPSIA AS INFLUENCED BY THE ADMINISTRATION OF VERATRUM VIRIDE

	TIME	CONTROL DAY		TEST DAY	
		INTAKE (C.C.)	OUTPUT (C.C.)	INTAKE (C.C.)	OUTPUT (C.C.)
I.	6 A.M. to 12 N.	600	320	500	210
	12 N. to 6 P.M.	700	780	500	240
	6 P.M. to 12 M.	500	350	500	210
	12 M. to 6 A.M.	120	60	120	120
		1920	1510	1620	780
II.	6 A.M. to 12 N.	2400	1810	2200	797
	12 N. to 6 P.M.	700	1140	800	403
	6 P.M. to 12 M.	200	731	400	1100
	12 M. to 6 A.M.	0	495	200	525
		3300	4176	3600	2825
III.	7 A.M. to 12 N.	2250	2190	2250	1103
	12 N. to 8 P.M.	550	270	550	740
	8 P.M. to 12 M.	400	140	400	355
	12 M. to 7 A.M.	0	205	0	275
		3200	2805	3200	2473
IV.	10 A.M. to 4 P.M.	600	350	600	290
	4 P.M. to 10 P.M.	900	460	900	260
	10 P.M. to 4 A.M.	0	310	0	290
	4 A.M. to 10 A.M.	300	395	300	295
		1800	1515	1800	1135

The urine volume in patients Nos. 10 and 11 was not significantly altered by the drug, however, there occurred a marked reduction in patient No. 12. In the latter only 37 c.c. of urine were excreted during the six hours of Veratrone administration.

No ill effects were noted as far as the babies were concerned. There was no interference with the mechanism of labor in any of the patients who were in labor. No instances of circulatory collapse were encountered, but vomiting occurred commonly.

Discussion

Any program of treatment for the patient with pre-eclampsia or eclampsia must include measures directed toward control of convulsions and maintenance, or stimulation of renal function; reduction of blood pressure is of less importance and is usually necessary only if it reaches a dangerously high level. The pregnancy must, at least in the initial stages of treatment, assume a position of secondary importance unless the patient is in active labor. Since no single drug is known which will satisfactorily accomplish all these things, a combination of medications is utilized in most standard treatment regimes. The barbiturates, magnesium sulfate and morphine, when administered in adequate dosages, will control the convulsions and the hypertension in most cases. Of more importance than this, however, is the maintenance of adequate urine production either in the severe pre-eclamptic to aid in preventing eclampsia, or as a definitive step in treatment in the latter condition. Reduction of blood pressure even to normal levels in these conditions may result in definite

depression of renal function (Fig. 3). McGee[12] has demonstrated that there occurs a diminution in urine output following depression of blood pressure by barbiturates, with a return to normal as the pressure rises following the injection of ephedrine. The studies of Warthin and Thomas[13] showed that following the

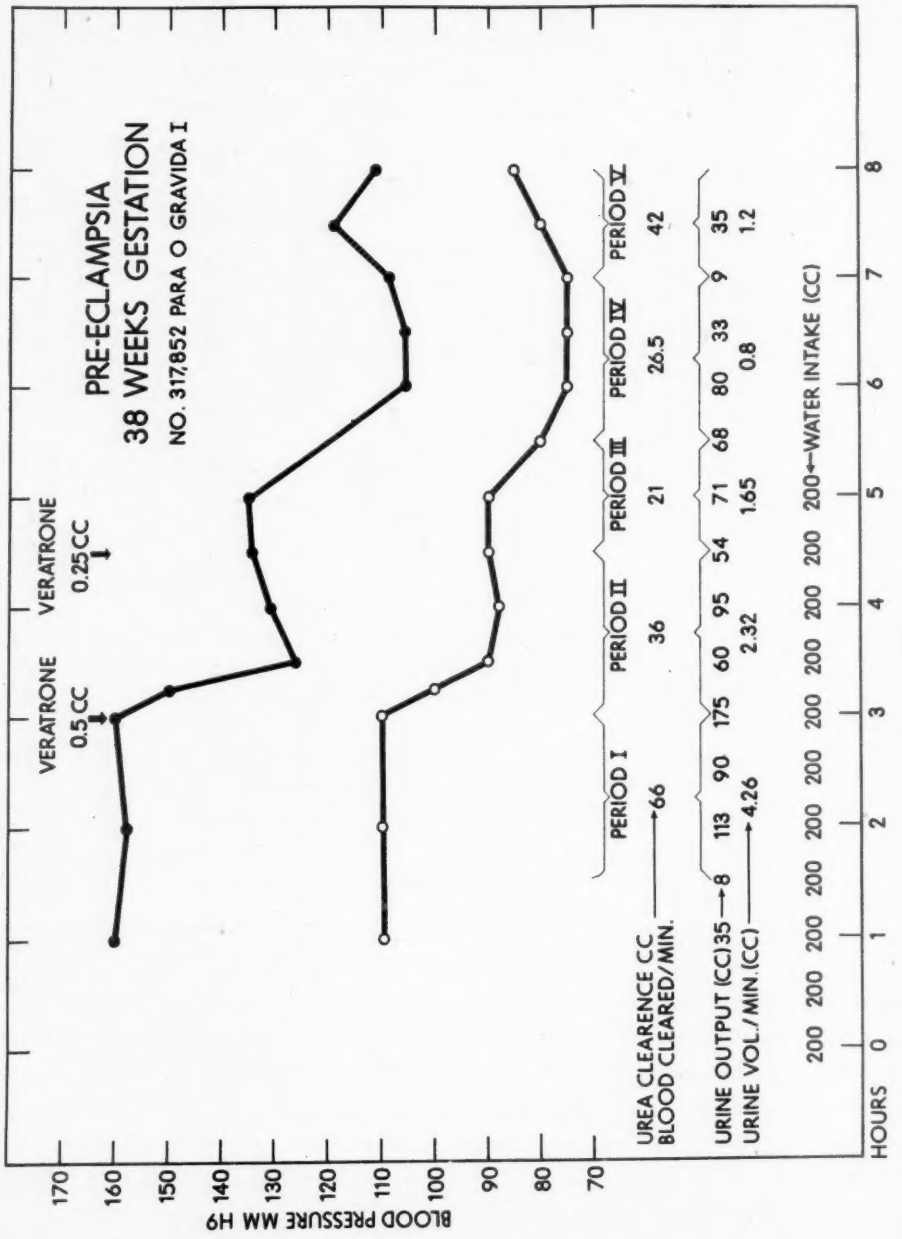

Fig. 3.

intraperitoneal injection of pentobarbital in dogs there occurs a diminution in renal blood flow and glomerular filtration as the blood pressure falls. That reduction of blood pressure is not necessary for a return to normal kidney function is evidenced by the fact that during the puerperium diuresis may begin,

while the pressure remains at a level as high as that prior to delivery, at which time urine excretion may have been markedly impaired. Thus, it seems probable that the hypertension is beneficial in maintaining kidney function, and that only in the severe pre-eclamptic or eclamptic is it unable to compensate for the abnormal renal physiology. The intravenous injection of hypertonic glucose

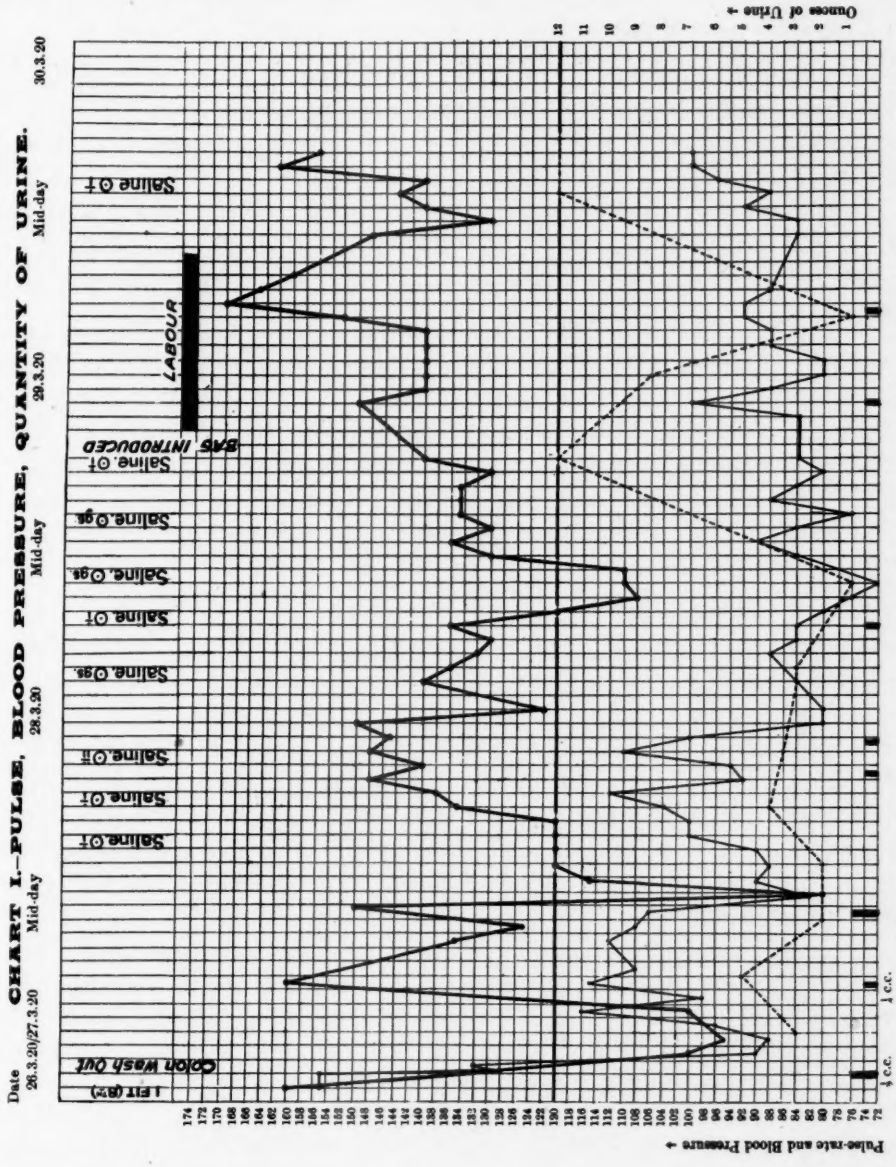

Fig. 4.—(Reprinted with permission—J. Obst. & Gynaec. Brit. Emp. 29: 432, 1922.)

solutions is by far the most effective method of insuring adequate renal function; Dieckmann[14] states that the introduction of the use of such solutions was one of the outstanding contributions to the treatment of eclampsia.

Veratrum viride meets the requirements for the treatment of toxemia only in that it will reduce the blood pressure which, as pointed out above, may

be detrimental. Older authors state unequivocally that its use likewise controls convulsion. Brodhead[15] maintained that "There can be no question that the drug will usually control convulsions if the pulse can be lowered to about 60," and Jewett[16] that "Convulsions cannot occur with a pulse less than 60." Since the more modern writers have for the most part used *veratrum viride* only as an additional drug in the treatment of eclampsia, recent results referable to control of convulsions are unreliable.

The reduction of urine volume in the pre-eclamptic patients treated with *veratrum viride* alone is striking. In a previous paper[11] the author reported a maximum reduction of 95.7 per cent in a group of such patients after the administration of the drug. This was likewise observed in this series. *At no time was the injection of veratrum viride followed by an increase in urine output,* and in four instances it was felt that the patient was dangerously close to eclampsia as a result of failure to excrete urine. All responded, however, to the prompt administration of glucose.

Bourne,[17] in 1922, reporting a case of eclampsia treated with veratrone, stated that the urine output was increased after the drug was administered. The urine volumes during the 2-day treatment period, however, varied from 40 to 150 c.c. every four hours, with the exception of the last four hours before delivery when 360 c.c. were excreted. Each drop in blood pressure produced by an injection of veratrone was followed by a diminution in urine volume which increased as the blood pressure rose (Fig. 4).

This renal failure may be explained by several factors, the first of which is the blood pressure. If the level of the systemic pressure is reduced to a point at which the renal blood pressure is below that necessary for glomerular filtration, urine excretion will cease. It appears from these studies that the lowest pressure necessary to carry on kidney function is higher in pre-eclampsia than in normal pregnancy. The second factor is blood volume: in severe pre-eclampsia and eclampsia the blood is concentrated due to withdrawal of water to the tissues, and any increase in renal output must of necessity be preceded by blood dilution. That this does not occur following the administration of *veratrum viride* is demonstrated by the fact that in a small group of patients in whom the hematocrit and serum proteins were determined both before and during veratrone therapy, no alteration was noted.[18] The third action of the drug which may depress renal function is its effect on the circulation time. This was increased in some instances to double that during the control period;[18] thus less blood is being delivered to the glomeruli for filtration.

The addition of *veratrum viride* to standard treatment routines has resulted in no marked increase in maternal salvage. MacCallum,[19] in 1887, in discussing Oatman's paper, reported 14 consecutive cases to whom no veratrum was given without mortality. Solomons,[20] in 1922, had a 10 per cent mortality in 204 cases treated by starvation, stomach lavage, magnesium sulfate, sodium bicarbonate enemas, and morphine, as compared to a report by Stevens[21] in the same year of 25 patients treated by *veratrum viride* and induction of labor with a 16 per cent death rate. In 1935, Bryant[3] reported a mortality rate of 10 per cent for 121

patients, and in 1940 with Fleming,[4] a mortality of 1.7 per cent in 120 cases in which veratrum was used in addition to sedation, glucose, and induction of labor, while in 1945 Arnell[22] reported 142 consecutive cases of eclampsia without a fatality, no *veratrum viride* being administered. The combined mortality rate for 86 patients treated at the Chicago Lying-in Hospital, and 52 patients treated at the St. Louis Maternity Hospital under the supervision of Dieckmann is 10 per cent.[23] *Veratrum viride* was not used.

The results reported in this and previous publications indicate that on a purely physiologic basis *veratrum viride* produces an effect exactly opposite that which is desired for a rational therapeutic regime for eclampsia. Although eclamptic patients have not been studied under the conditions reported here, it seems unlikely that the drug would have a beneficial effect on a disease which, with the exception of the convulsions, is identical to severe pre-eclampsia in which *veratrum viride* does nothing to improve the abnormal vascular-renal physiology.

Conclusions

1. *Veratrum viride* was administered to a group of patients with pre-eclampsia and hypertension complicating pregnancy both before and during labor. No other drug was used.

2. The blood pressure and pulse rates in the pre-eclamptic patients were consistently reduced, but apparently to the detriment of adequate renal function, an undesirable consequence in these individuals.

3. The good results in series of patients treated with *veratrum viride* can be duplicated in series in which the drug was not used.

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THE TREATMENT WITH MASSIVE ARSENOTHERAPY OF EARLY SYPHILIS COMPLICATED BY PREGNANCY

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THE transmission of syphilis from mother to fetus should be preventable. However, in spite of this, prenatal syphilis still remains a feticidal and stigmatizing disease because syphilis in the mother is unrecognized, untreated, or poorly treated. Inadequate treatment may be due to the choice of drugs or the plan used in their administration. It often is a result of insufficient time, after diagnosis is made, to give adequate protective therapy. Laxity on the part of the patient in receiving the outlined therapy may also be a factor. Rapid treatment should solve all of these problems.

In a large series of pregnant, untreated, latent syphilitic women, Jeans[1] found only 16.9 per cent of their infants were nonsyphilitic. Thirty and three-tenths per cent of their conceptions either terminated in abortions or stillbirths. Infant mortality was 30.2 per cent. Twenty-four per cent of the children of these mothers were stigmatized with congenital syphilis. Comparing these figures with the average incidence of fetal mortality in normal women, Jeans reported 76 per cent delivered healthy infants, 15 per cent of the infants died in infancy, and 9.7 per cent of the pregnancies resulted in miscarriages or stillbirths.

Marshall's[2] report on early syphilis (infections of less than five years' duration) without antisyphilitic treatment complicated by pregnancy is somewhat similar. Twenty-two per cent of the children were normal; 48 per cent of the pregnancies resulted in miscarriages or stillbirths, and 30 per cent were syphilitic infants. In another series of pregnant women with syphilis treated with 2.3 Gm. of arsphenamine and 0.5 Gm. of mercuric salicylate during the pregnancy, 65 per cent of the infants were normal; 6 per cent of the pregnancies resulted in abortions, and 8 per cent in stillbirths. Twenty-one per cent of the infants had syphilis.

McKelvey and Turner[3] reported their study of a series of pregnant women with latent syphilis, who received a total of 2.0 Gm. of arsphenamine during the second and third trimester of pregnancy. Seventy-eight per cent of the infants born of these mothers were normal and 22 per cent had syphilis. When 2.0 Gm. of arsphenamine plus mercury or bismuth were given during the second and third trimesters, the rate of normal infants increased to 93.4 per cent, and the syphilitic infant percentile decreased to 6.6. When a total of 4.0 Gm. of arsphenamine was given during any stage of the pregnancy, approximately 100 per cent of the infants were normal. If treatment was not started until the last trimester with weekly injections of arsenic and bismuth, 77.7 per cent of the infants were normal and 22.2 per cent had syphilis. If no treatment was given to the mothers, 64.5 per cent of the infants born of these mothers had syphilis.

Castallo, Coppolino, Rakoff, Roeder, and Dickson[4] found that if 240 mg. of mapharsen and 360 mg. of bismuth were given to late latent pregnant women, 90.7 per cent of their children were live births, 7 per cent stillbirths, and 2.3

per cent miscarriages. Ten per cent of the live births had positive Wassermann serologic tests at the end of four months; a good indication that they had syphilis.

Dippel[5] autopsied 68 fetuses of adjudged nonsyphilitic women and 67 fetuses of syphilitic women. Spirochetes were found in the fetal organs of 23.9 per cent of the fetuses of syphilitic mothers, and none in the other group. Spirochetes were not found in any fetus prior to the eighteenth week of gestation. The highest incidence of syphilis was found in the fetuses (66.7 per cent) at the twenty-sixth week. Dippel concludes that antisyphilitic therapy should be started before the eighteenth week of gestation in order to prevent the invasion of the fetus by spirochetes. He also presents important evidence to show that Langhan's layer of the chorionic epithelium affords appreciable protection to the fetus against invasion by the *Spirochaeta pallida,* until it becomes thinned sometime during the sixteenth or eighteenth week of pregnancy.

In 1942, Sadusk and Shaffer[6] first reported using massive arsenotherapy in the treatment of early syphilis shortly before and shortly after the beginning of pregnancy. The patients received the five-day drip method of Hyman, Chargin, and Leifer, consisting of the administration of 1,200 mg. of mapharsen by intravenous drip over a period of five days. Two of the four reported cases became pregnant, two and three months respectively, following completion of treatment. Both women remained seronegative and delivered normal seronegative babies, which remained negative for six months. The other two cases were pregnant five and fourteen weeks respectively at the time of treatment, but unfortunately no follow-up report on these pregnancies is given.

In 1943, Rattner[7] reported the use of the five-day arsenic rapid treatment in 27 cases of pregnant women with syphilis. Eight of the patients had early latent syphilis, the rest early infectious syphilis. The majority were five or more months pregnant, and none had received previous antisyphilitic treatment. The results show that twenty-five of these women delivered normal babies. One was apparently reinfected just prior to delivery, and one could not be followed.

Speiser, Wexler, Thomas, and Asher[8] reported their results on 43 pregnant women treated for syphilis with rapid mapharsen therapy. One death from arsenical arsenotherapy occurred in this group. Thirty patients who had early infectious syphilis were kept under observation. Their probable good results were 85 per cent.

In January, 1942, we began the treatment of syphilis in pregnant women with massive arsenotherapy. The first method used followed that outlined by Hyman, Chargin, Rice, and Leifer,[9] using 240 mg. of mapharsen in 2,000 c.c. of 5 per cent glucose given intravenously daily for five consecutive days. The mapharsen glucose solution was given at the rate of approximately 4 c.c. per minute, and took from eight to ten hours for completion of the daily dose. A total of 1,200 mg. of mapharsen was given to each patient. In addition to the mapharsen, each patient received 130 mg. of bismuth subsalicylate in oil intramuscularly at the start, and again at the completion of treatment, making a total of 260 mg. of bismuth. Twenty-nine women with early syphilis and pregnancy, and one woman with congenital syphilis and pregnancy were treated by this method.

In January, 1945, we discontinued the use of the five-day massive arsenotherapy because of its toxicity[10]* and began a modification of it which, we be-

*Toxic reactions were moderately severe with the five-day treatment. Sixty per cent had nausea and vomiting on the first day of treatment. It rarely continued into the second day of treatment. Thirteen per cent had primary fever, 10 per cent secondary fever, 3.3 per cent toxicodermas, and 1.3 per cent (one case) had an arsenical encephalopathy.

lieved, would be as effective but less dangerous. Two hundred and forty milligrams of mapharsen were dissolved in 2,000 c.c. of 5 per cent glucose and administered by slow drip intravenously the first day, and then 120 mg. of mapharsen in 1,000 c.c. of 5 per cent glucose intravenously for the next seven days, making a total of 1,080 mg. of mapharsen. This solution was delivered at the rate of 2 c.c. per minute. In addition to the mapharsen, 130 mg. of bismuth subsalicylate in oil were injected intramuscularly on the first, third, sixth, and ninth days. Using this regimen, we treated ten cases of early syphilis complicated by pregnancy.*

Before treatment was started, the following procedures were routinely done: a complete routine physical examination, including a dark-field examination of syphilitic lesions, if present; a Kahn quantitative blood serologic test for syphilis, and a spinal fluid examination, regardless of the stage of pregnancy. A chest roentgenogram, a bromsulfalein test, and a phenolsulfonphthalein test were done to make sure no liver or kidney damage was present. No patient with abnormalities in the latter two procedures was given massive arsenotherapy A routine blood count and urine examination were performed on each patient.

TABLE I. RESULTS OF MASSIVE CHEMOTHERAPY ON FORTY PREGNANT WOMEN WITH SYPHILIS ON THIRTY-EIGHT OF THEIR INFANTS

SYPHILIS	AGE OF PREGNANCY	PREGNANT WOMEN	MOTHERS' SEROLOGIC TITER	CORD BLOOD SEROLOGIC TEST			BLOOD SERONEGATIVITY MAINTAINED BY		INFANTS NOT FOLLOWED
				NEG.	N.D.	UNITS	MOTHERS	INFANTS	
TYPE	TRIMESTER	NUMBER	UNITS	NO.	NO.	NO.	MONTHS	MONTHS	NUMBER
Primary	First	2	0 to 80	1	1	–	16 to 18	3 to 18	
	Second	1	0	1	1	–	10	12	
	Third	1	40	1	1	–	15	18	
Early secondary	First	6	40 to 320	5	1	–	8 to 27	3 to 8§	1
	Second	14	40 to 160	7	7	–	8 to 27	3 to 27‖	1
	Third	7	40 to 280	7	–	–	8 to 27	3 to 24 ¶	1
Late secondary	First	0	–	–	–	–	–	–	
	Second	1	560	1	–	–(1)	12	8	
	Third	1	80	–	–	4	27	24	
Early latent	First	1	40	1	–	–(1)	18*	4	
	Second	4	40 to 120	4	–	3(1)	24 and 33†	8 to 21	
	Third	1	80	–	–	4	36‡	6	
Congenital	First	0	–	–	–	–	–	–	
	Second	1	80	1	–	–	14	3	
	Third	0	–	–	–	–	–	–	

*1 Mother had 4 units at eighteen months.
†2 Mothers had 4 units at twenty-four and thirty-three months.
‡1 Mother had 4 units at thirty-six months.
§1 Child died at the age of seven days. Autopsy virus enteritis. No syphilis.
‖1 Child died at the age of three months. Serology negative one week prior.
¶1 Child died at the age of fifty-six hours. Polycystic kidney disease. No syphilis.
N.D.—Note done.

Massive Arsenotherapy Results

Table I shows that, in the total of forty pregnant women treated, thirty-eight of their infants have been checked since delivery. All were normal term deliveries. No stillbirths or abortions occurred.

There were four patients who had dark-field positive primary syphilis; two cases were in the first trimester of pregnancy, and one each in the second

*With the eight-day treatment 20 per cent had nausea and vomiting, 20 per cent secondary fever, and 20 per cent toxicoderma. All the reactions were minor.

and third trimester of their pregnancy. The mothers' serologic tests varied from 0 to 8 units. One baby was followed for three months, one for twelve months, and the other two for eighteen months. All remained serologically and clinically negative. The mothers returned to seronegativity within two months after treatment, and remained seronegative throughout the next ten to eighteen months.

There were twenty-seven cases of early secondary syphilis. None had received previous therapy and all were seropositive and dark-field positive, with serologic titers varying from 40 to 320 units.

Six patients were in the first trimester of pregnancy. Four of their babies were followed from three to eight months, and remained seronegative and normal infants. One child could not be followed; one child died at the age of seven days. An autopsy diagnosis was made of virus enteritis without evidence of syphilis.

Fourteen patients were in the second trimester of pregnancy. Eleven children of this group were followed from three to twenty-seven months, and all remained serologically and clinically negative. Two children were not followed. One died at the age of three months of an unknown cause, but without evidence of syphilis. A serologic test on this infant one week prior to death was negative. It is interesting to note that three of the mothers had threatened abortions with severe cramps and spotting on admission. They were immediately treated with massive arsenotherapy and sedation. After the third day of treatment the spotting and cramps disappeared. Delivery was at term.

In the third trimester of pregnancy, seven women were treated. Four infants remained negative and normal throughout a period of three to twenty-four months. One child died two and one-half days after birth. An autopsy showed polycystic kidneys, but no evidence of syphilis. Two children could not be checked after birth. The twenty-seven mothers of these babies became seronegative at the end of eight months and remained clinically and serologically negative throughout a period of eight to twenty-seven months.

There were two patients who had late secondary syphilis. Both were dark-field positive and the serologic titers were 80 and 560 units. One woman was in the second trimester of pregnancy when treatment was instituted. Her child's development was normal, and the infant remained seronegative throughout a period of eight months. The second woman was nearing term when treatment was begun. She delivered the day following completion of treatment. There were no signs of syphilis in the baby. In two weeks the infant's blood test was negative and remained repeatedly negative through twenty-four months. The child's development was normal. Both mothers reverted to seronegativity at the end of five months and remained seronegative through twelve and twenty-seven months, respectively.

There were six women who had early latent syphilis (syphilis less than four years old) and pregnancy. One woman had previously received a few bismuth injections. The other five were untreated.

One woman was in the first trimester of pregnancy. Her baby developed normally and was seronegative four months later.

There were four women in the second trimester of pregnancy. Their serologic titers ranged from 40 to 120 units. Five infants resulted from these four pregnancies. All babies developed normally. All remained seronegative throughout a period of eight to twenty-one months.

One woman was in the third trimester of pregnancy and had a serologic titer of 80 units. Her baby was seronegative at the end of three months and remained seronegative for six months.

All six of these women received bismuth subsalicylate in oil, at weekly intervals from the time rapid massive arsenotherapy was discontinued until delivery. Two of the mothers reverted to seronegativity and remained negative for two years. Four have shown a gradual drop in serologic titer and, when last checked, two to three years after treatment, were positive at 4 units only. This type of slow serologic titer change, or even serologic titer fastness is not unusual in latent syphilis, even after massive arsenotherapy.

One woman, who had congenital syphilis and acute interstitial keratitis, and who was in the second trimester of her pregnancy, was treated with the five-day treatment. Her serologic titer was 80 units. The child's development was normal. The serologic test remained negative throughout three months of observation. The mother reverted to negativity within three months and remained seronegative throughout the fourteen months observed.

Three women became pregnant the second time. None was given treatment after the original massive arsenotherapy. Previously two of the women had early secondary, and the third early latent syphilis. One delivered two years and eight months after treatment, the other two, twenty-one months after treatment. Two infants were checked at the end of three months. Both were clinically and serologically negative. The serologic test on both mother and third infant was negative at birth. The infant has not been checked since.

The above data are summarized in Table I.

Discussion

The diagnosis of congenital syphilis may be made certain by a dark-field examination of serum from the umbilical vein or infant skin. However, other less accurate procedures are usually used, such as the examination of the placenta for gross pathologic as well as microscopic changes; the cord blood serologic test; an x-ray of the infant for periosteal and bone changes, and the common physical signs of congenital syphilis. Unfortunately the two most common procedures used for the diagnosis of prenatal syphilis are the cord blood serologic test and the pathologic examination of the placenta. Both of these procedures are valueless in making such a diagnosis, and may even lead to erroneous conclusions.

Faber and Black,[11] Christie,[12] and others have demonstrated that maternal syphilitic reagin may appear in the blood of nonsyphilitic infants in titer equal to or lower than that in the mothers' blood. A positive serologic test obtained from cord blood may be then only an index of the mothers' reagin and not the infants.' Maternal reagin remains in the infants' blood for varying lengths of time. It usually disappears during the first month of life, but has been demonstrated in measurable quantities for as long as seventy days. For unknown reasons, cord bloods done by complement fixation tests are more prone to be positive than when done by flocculation tests.[13]

Ingraham[14] has shown that eighty-seven such infants with initially positive serologic tests, which subsequently reverted to negative, showed no evidence of late congenital syphilis six years later. Table I shows that three infants in this series had positive cord blood tests. All became negative in three months, without treatment.

If a child is infected in utero or in the birth canal, the cord blood can be either negative or positive. If negative, the blood serologic test will become positive sometime before the twelfth week as the infant develops its own syph-

ilitic reagin. If positive, it may become negative, then again positive. This is due initially to the presence of the mother's reagin, which at first causes the positive reaction. The disappearance of the mother's reagin leads to a short period of negativity. Later the child develops syphilitic reagin from its own infection and the serologic test is again positive. These facts show that an infant with a positive cord blood serologic test may ultimately prove to be non-syphilitic. A child with a negative cord blood serologic test may later develop congenital syphilis. The serologic test on cord blood is evidently worthless as a working tool for the diagnosis of congenital syphilis. If positive, it may lead to unnecessary treatment of a healthy child; if negative, it may give a false security, which delays necessary treatment and eventual stigmatization of the child. Three infants reported in this series had positive cord blood serologic tests. All became negative without treatment for six, eight, and twenty-four months. See Table I.

The placenta has long been examined for evidence of syphilis. Its value as a diagnostic aid in identifying congenital syphilis in a living child has been shown to be worthless by Dill, Stander, and Isenhour.[15] In none of his cases of congenital syphilis was the placenta positive pathologically. Dill has shown that most infected placentas are found in macerated fetuses, which lead to abortion and not viable infants. He has also drawn attention to similar vascular abnormalities in the placenta due to causes other than syphilis.

It would seem, then, that the two special types of examination most commonly used for the diagnosis of congenital syphilis should both be discarded. In the absence of the physical signs of syphilis, diagnosis should depend upon a dark-field examination of cord serum, x-ray change of the periosteum and bones, and a blood quantitative serologic test done eight to twelve weeks after birth.

Massive arsenotherapy offers a rapid and highly efficient method for treating early syphilis associated with pregnancy. It is our opinion that many of the patients with early syphilis treated by this method are not only serologically, but biologically, cured. We believe this applies to the fetus in utero as well as to the mother. Even in the last trimester of pregnancy, when there is insufficient time for routine treatment, none of our infants had syphilis. There were no abortions or stillbirths in forty patients treated. Two threatened abortions were alleviated. The reactions due to the treatment are appreciable. Hemorrhagic encephalitis may even be a fatal complication. However, no other form of antisyphilitic treatment has offered such good results to date. Penicillin will probably be as efficacious and much less hazardous.

Summary and Conclusions

1. Forty women with syphilis, complicated by pregnancy, were treated with massive mapharsen therapy.

2. Thirty-three infants born of these mothers were kept under observation through at least three months of age. Five could not be followed. Three infants died. Two were autopsied and had neither clinical, serologic, nor pathologic

evidence of syphilis. The third infant was not autopsied. It had no serologic or clinical evidence of syphilis at three months of age. Thirty-three infants developed normally and remained seronegative. Three mothers became pregnant a second time. None was again treated. Two infants, born of these mothers, were observed for three months and remained serologically and clinically negative.

3. All mothers with primary or secondary syphilis returned to seronegativity and remained so through at least two years.

4. There were no abortions, miscarriages, or stillbirths in this group.

5. The diagnosis of congenital syphilis is discussed.

6. Massive arsenotherapy offers the pregnant patient with *early* syphilis a probable cure of her syphilis and a noninfected baby.

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CRITICAL STUDY OF 390 MAJOR GYNECOLOGIC SURGICAL PROCEDURES*

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IN ORDER to insure the best possible medical and surgical care for patients under professional treatment, errors in judgment must be searched for and corrected. A very meticulous and painstaking search must be made, for a patient's life may depend on a single laboratory or physical finding. With that thought in mind, a critical analysis of 390 major gynecologic surgical procedures has been undertaken. These patients were operated upon at the Los Angeles County Hospital in 1943 and 1944. For the most part, the patients were taken from the gynecologic service of Dr. Roy Fallas, senior attending physician.

TABLE I

OPERATION	INTERN		RESIDENT		ATTENDING STAFF	
	NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Subtotal hysterectomy	19		26		10	
Subtotal hysterectomy plus	15		183		27	
Total abdominal hysterectomy	0		35		4	
Total hysterectomy plus	0		4		2	
Vaginal hysterectomy	0		14		5	
Adnexal surgery	6		22		3	
Miscellaneous	0		11		4	
Totals	40	10.3	295	75.6	55	13.1

The operators were the intern on the service, the resident physician, and the junior attending or senior attending physician. Table I shows the distribution of surgical procedures and operators.

From this table it will be seen that the resident physician does the major part of the surgery. He is at all times under the direction and supervision of the attending staff.

During the period of one year covered by this study there were a total of 801 admissions to the Los Angeles County Hospital gynecologic service, from which the 390 major operative patients were taken. Therefore, 48.6 per cent of the patients admitted to the hospital from the diagnostic clinic and main admitting room underwent major surgery. It has been the policy of the admitting services of this hospital during the war emergency to admit only patients requiring emergency care. Therefore the surgical incidence would be necessarily high.

Statistics

The average age of the patients undergoing surgery was 34.4 years. Of this group of women 66 per cent, or 257, were parous—the average number of chil-

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dren being 2.7. Twenty per cent of the patients had never been pregnant, whereas another fourteen per cent had had an average number of 1.9 abortions. The average stay in the hospital was 20.9 days. The average stay preoperatively was 8.9 days; postoperatively, 12.0 days.

Twenty-three per cent of the patients had undergone previous major surgery. Morbidity and mortality in the present surgery were not appreciably affected by this previous surgery.

At this point previous errors in doing "incomplete surgery" should be pointed out and stressed. There were sixty-three patients (16 per cent) that had undergone previous pelvic surgery. Twenty-one patients had undergone previous tubal ligation for sterilization purposes. Now these patients complained of menometrorrhagia, backache, pelvic pain, etc., to the extent that they were chronic invalids requiring further surgery, and really adequate sterilization consisting of hysterectomy and bilateral salpingectomy. Eighteen of these twenty-one patients had varicosities in the broad ligaments at surgery. Time and again this situation has presented itself. It cannot be stressed too sharply that when an abdomen is opened principally for sterilization purposes, an adequate sterilization should be carried out. This does not imply that tubal sterilization does not have its place, but its successful utilization is rapidly decreasing. In a period of three years at the Los Angeles County Hospital there have been six incidences of pregnancy following tubal "sterilization."

Thirty-one patients had further incomplete surgery consisting of unilateral salpingectomy and/or oophorectomy, etc., for inflammatory disease. Boyd[1] states that a specific salpingitis is practically "always bilateral." Curtis[2] states that a "specific salpingitis is almost invariably bilateral." Other writers agree that if one tube is involved, both tubes are practically always involved. Wharton, Curtis, and Henrikssen all advise removal of both tubes and a hysterectomy for all operations for salpingitis. Emergency surgical procedures, such as ectopic pregnancy, appendectomy, ruptured pyosalpinx, or simple drainage of pelvic abscesses are exceptions, of course. Incomplete surgery in pelvic inflammatory disease will often terminate in ectopic pregnancy, pyosalpinx, and further surgery.

Incomplete surgery consisting of bilateral salpingectomy without hysterectomy accounted for several patients with uterine hemorrhage requiring further surgery. Too often the uterus is the site of a concomitant metritis, or is subject to aberrant hormonal stimulation following bilateral salpingectomy.

TABLE II. INDICATIONS

	PELVIC INFLAMMATORY DISEASE		FIBROID		RELAXATION	
	NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Pain	217	55	14	3.6	0	0
Bleeding	99	25	77	19.7	2	0.5
Tumor (pressure)	8	2.0	55	14.1	0	0
Discharge	77	19.7	28	7.1	4	1.0
"Something falling out," and so forth	0	0	0	0	37	9.5

Subjectively, pain and hemorrhage either individually or collectively were the presenting symptoms in 81 per cent (316) of the patients. The presence of a "tumor" or/and pressure symptoms brought another 14 per cent (55 patients) to the hospital. Nine and five-tenths per cent (37) came because of prolapse, "womb falling out," "something coming out," and so forth. Miscellaneous complaints brought in 37 patients, or about 10 per cent.

Objectively, pelvic inflammatory disease was the principal diagnosis in 43 per cent, or in 168 patients. Fibromyomata uteri with and without pelvic inflammatory disease was the principal diagnosis in 38 per cent, or in 149 patients. Uterine hemorrhage, shock, acute pelvic pain, etc., account for the additional 19 per cent, or 73 patients.

As pelvic inflammatory disease was the principal indication for surgery, it will be seen that the criteria for surgery in inflammatory disease are rather uniform. If the disease is persistent to the point of making the patient a chronic invalid, surgery is advised. Repeated, crippling, incapacitating recurrences of pelvic pain, uterine bleeding, chills, and fever to the point of complete exhaustion of the patient are evidence enough for surgery. Conservative medical treatment should be faithfully and patiently carried out. Most often pelvic inflammatory disease will resolve under a careful medical regime.

TABLE III. PATHOLOGY (POSTOPERATIVE)

Pelvic inflammatory disease		242
Fibromyoma		167
Pelvic inflammatory disease plus fibromyoma		137
Ovarian cystoma		47
Retention cysts	24	
Papillary serous	9	
Dermoid	7	
Pseudomucinous	4	
Miscellaneous	3	
Ectopic		37
Endometriosis		12
Carcinoma of the fundus		10
Sarcoma		3
Endometrial	1	
Botryoides	1	
Leiomyosarcoma	1	
Actinomycosis		1
Tuberculous salpingitis		1
Miscellaneous		9

Pelvic inflammatory disease was the chief pathologic finding, as shown in Table III, and in this hospital represents the ultimate and usually the most advanced stage of pathogenesis. Thirty-four per cent of the patients with pelvic inflammatory disease had tuboovarian abscess, one or two, at the time of surgery. In all types of pathology seen in an institution such as this, the disease process has usually run its course. The state of exhaustion, malnutrition, and degree of pathology seen in these patients is not usually seen in private patients.

One interesting observation is the twelve cases of endometriosis in a series of 390 gynecologic laparotomies for an incidence of 3.0 per cent. It was recently shown that there is a much greater percentage of endometriosis in private practice among patients in the higher social and economic levels than in the charity patients in such an institution as the Los Angeles County Hospital. The incidence among private patients is quoted from 10 per cent to 32.2 per cent by various authors. Dr. Roy Fallas[3] reports an incidence of 37 per cent in his last series of 100 laparotomies. Reasons for this variance have been explained by delay in childbearing or years and years of menstruation without interruption (Meigs[4]). Use of contraceptive devices is also a point of contention.

Other interesting reports from the pathologist are: a case of sarcoma botryoides—the grapelike sarcoma of the cervix, corpus in children or infants, and, in this instance, in a 52-year-old Ethiopian woman. One case of endometrial sarcoma is reported. One case of leiomyosarcoma was found on examination. One case of pelvic actinomycosis is reported, which responded to penicillin, surgery, and postoperative irradiation.

Diagnosis

A correct diagnosis preoperatively was made in 69 per cent of the patients. Each patient before surgery was examined by the intern, resident, and attending physician. The diagnosis was partially correct in 16 per cent of the patients. In 15 per cent the diagnosis was erroneous.

Surgery

Surgical procedures carried out are shown in Table IV.

TABLE IV

OPERATION	NUMBER	PER CENT	STAY IN HOSPITAL POSTOPERATIVELY	MORBIDITY (PER CENT)	MORTALITY	OPERATING TIME IN MINUTES
Subtotal hysterectomy	55.0	14.1	10.2	26	0	54
Subtotal hysterectomy plus	225	57.7	10.4	36	1.0	66
Total abdominal hysterectomy	39	10.0	12.2	24	0	68
Total abdominal hysterectomy plus	6	1.5	12.7	30	0	72
Vaginal hysterectomy	19	5.0	13.1	54	1.0	78
Adnexal surgery	31	8.0	9.8	38	1.0	37
Miscellaneous	15	3.8	10.5	31	1.0	47
						(Average 60 minutes)

The relative infrequency of total abdominal hysterectomy and vaginal hysterectomy is explained by several reasons. Total abdominal hysterectomy is not an easy procedure in the most experienced operators' hands. In the presence of such advanced stages of pathologic disease as is seen in such a series, particularly in the pelvic inflammatory disease cases, it is felt that the morbidity and mortality figures would prohibit the use of the total hysterectomy, except in these cases where there is an absolute indication for the extirpation of the cervix also. Extensive cellular exudates and vascularity with dense adhesions make total hysterectomy difficult and dangerous in these cases.

We will not attempt to evaluate the total versus subtotal arguments, as that is not within the scope of this paper.

The average operating time from skin incision to complete skin closure was sixty minutes. The shortest operation was twelve minutes on a ruptured ectopic, to the longest procedure of one hundred thirty-five minutes on anterior and posterior repair and subtotal hysterectomy. The latter procedure was too much surgery for one sitting.

Vaginal hysterectomy was not done except in the presence of prolapse of the uterus. Various interpositional and complicated procedures from below were not attempted.

Anesthesia

Spinal anesthesia was the anesthetic agent of choice. Other types of anesthesia are shown in Table V.

TABLE V

Spinal	79%
Cyclopropane	12%
Ether	5%
Curare	1%
Caudal, miscellaneous	3%

There were no deaths or unusually severe accidents attributed to the anesthetic agent.

Morbidity

A temperature of 100.4° F. or more for two days, excluding the first postoperative day, was considered as a morbidity in this series. The morbidity incidence with these criteria was 20 per cent, or 78 patients. To emphasize contrast, morbidity, as shown in the tables and as otherwise quoted here, is based on a temperature of 100° F. or more on any *one* day, representing a morbidity of 34 per cent, or 133 patients.

Polak and Tollefson[5] have enumerated various criteria for lowering the incidence of morbidity and mortality in elective cesarean section. If these criteria are followed in all pelvic surgery, better results will follow. These criteria are:

1. A complete history and general physical examination.
2. A leucocyte count of between 7,000 and 10,000.
3. A polymorphonuclear percentage of from 65 to 80.
4. A hemoglobin of at least 60 per cent.
5. A sedimentation time of ninety minutes or more.
6. A normal urinalysis, and an adequate kidney function.
7. A temperature of 98.6° F. for at least forty-eight hours before operation.
8. A systolic blood pressure between 110 and 150.
9. A negative Wassermann test, and finally, that all elective preoperative patients have rest in bed in the hospital for a period of at least forty-eight hours, during which time the intake of fluids, water, milk, etc., must be at least two and one-half quarts per day, while the usual sugar intake of the individual must be at least quadrupled.

There have been other points of interest raised with regard to morbidity and mortality. Cashman and Fran[6] have shown that when cauterization of the cervix was done, particularly in subtotal hysterectomy, mortality was lowered from 6.5 per cent to 1.1 per cent in a series of about 1,500 cases. Also, deep cauterization of the cervix was shown by Cashman to be an effective method of preventing carcinoma of the cervix in a series of 10,000 cases. In this small series, cauterization of the cervix was thoroughly done in 316 (81 per cent) of the cases. In these 316 cases there were 82 morbidities, an incidence of 26 per cent. In the 74 patients (19 per cent) that did not receive the cautery to the cervix, there were 51 morbid patients, for an incidence of 69 per cent. Comparing a morbidity incidence of 26 per cent with the cautery used to a morbidity of 69 per cent with the cautery not used, it can readily be understood why thorough cauterization from below is a large factor in morbidity, mortality, and possibly incidence of cervical carcinoma.

Too much stress cannot be laid upon an absolutely afebrile period of at least one week before surgery, particularly in pelvic inflammatory disease. There was such a small percentage of the patients febrile before surgery that the value of having the preoperative period clear of fever cannot be clearly indicated. It is of utmost importance, however, and cannot be emphasized too much.

Considering Polak's and Tollefson's criteria as a unit, and adding cautery to the cervix, it is seen that 171 patients fulfilled all the requirements for surgery. In this group of patients, 29 were morbid for a percentage of 18 per cent. In further investigating, it is seen that 219 patients did not fulfill the requirements. Out of this group there were 105 morbid patients for a percentage of 47 per cent, more than twice as great a percentage of morbidity as shown in this carefully prepared group.

Various authors have mentioned what they consider as the more important criteria for operability of a patient. Considering these criteria in groups, it is seen that there is varying significance.

TABLE VI. MORBIDITY

CRITERIA	CRITERIA FULFILLED (PER CENT)	CRITERIA NOT FULFILLED (PER CENT)
As a whole	18	47
Cautery of cervix	26	69
Hemoglobin 60 per cent. White blood cells 7 to 10,000, with 60 to 80 per cent polymorphonuclears	17	63
Sedimentation rate, 20 mm. or less	27	57
Normal urine	13	74
Normal physical	30	38

It is plain that close attention must be paid to every detail before a patient is subjected to major surgery. Cautery to the cervix, a normal urine and blood work are among the more essential preoperative musts.

Causes of morbidity in so far as can be determined are listed in Table VII.

TABLE VII. PERCENTAGE OF DISTRIBUTION OF MORBID PATIENTS

CAUSE OF MORBIDITY	TOTAL ABDOMINAL HYSTERECTOMY (PER CENT)	SUBTOTAL HYSTERECTOMY (PER CENT)	VAGINAL HYSTERECTOMY (PER CENT)
Genitourinary	33	37	68
Pulmonary	22	23	0
Undetermined	39	30	20
Sepsis	2	7	12
Thrombophlebitis	1	2	0
Transfusion reaction	1	0	0
Miscellaneous	2	1	0

Operative Accidents

The urinary bladder was not knowingly injured in this series. The large and small bowels were inadvertently opened on one occasion in the same patient. Freeing extensive pelvic adhesions resulted in small multiple perforations in the small bowel and one larger perforation in the sigmoid. Six inches of small bowel were resected—and end-to-end anastomosis was done. The sigmoid was closed and a protecting simple loop colostomy was done above the defect. The patient recovered following closure of the colostomy.

There were no further operative accidents to our knowledge.

Appendectomy

Routine appendectomy was not done in this series. This was discussed with the patient preoperatively. The great majority requested removal. At operation, appendectomy was done if there were no contraindication such as further prolonging an already long period on the operating table, or as in ruptured ectopics, etc.

Twenty-one per cent of the patients, or 92, had already undergone appendectomy. A further 19 per cent, or 75 patients, had only plastic surgery or emergency surgery, such as ruptured ectopic, etc. Of the remainder, appendectomy was done in 60.4 per cent, or in 139 patients.

There were no unusual complications in the appendectomy group, such as wound infection, etc. The morbidity in the group that had appendectomy was 34.6 per cent, or 48 patients, slightly higher than the group as a whole—34 per cent. In the patients that did not have appendectomy, the morbidity was 29 per cent, or 84 patients, which is slightly less than the general group of morbidity, and noticeably less than the 34.6 per cent in the group that had appendectomy

Mortality

There were four operative mortalities in the entire series—an incidence of 1.03 per cent.

TABLE VIII. MORTALITY

AGE	CRITERIA FULFILLED	PREOPERATIVE DIAGNOSIS	SURGERY	CAUSE OF DEATH	OPERATOR
37	No	Pelvic inflammatory disease	Subtotal hysterectomy, bilateral salpingectomy, appendectomy	General peritonitis paralytic ileus, (autopsy)	Resident
45	No	Ovarian cyst with hemorrhage	Closure perforation, diverticulum drainage	General peritonitis (autopsy)	Attending
54	No	Ovarian cyst	Left oophorectomy	Coronary occlusion	Resident
43	No	Procidentia cystocele —rectocele	Anterior-posterior repair, vaginal hysterectomy	Uremia, chronic pyelonephritis (autopsy)	Attending

In no one case were the operative criteria, as previously outlined, fulfilled. In the first case the sedimentation rate was 32, despite seven weeks absolute rest in bed. She died on the eighth postoperative day from causes as above outlined. This death could probably have been prevented had the patient waited in bed. The responsibility rests with the doctor. An autopsy was done.

The second case had a large papillary serous cystadenoma which was causing dyspnea and other pressure symptoms. Her blood pressure was 210/115. A spinal anesthetic was given, consisting of 100 mg. of procaine and 2 mg. of nupercaine. The blood pressure dropped to 160/100 at its lowest point during the surgery. She died suddenly on the third postoperative day with what was clinically diagnosed as coronary occlusion. Perhaps drop ether should have been used—certainly not the nupercaine.

The third patient died of a general peritonitis secondary to a perforated diverticulum and pelvic abscess. She was an obese Caucasian woman with a pelvic mass. Her white blood count was 12,700 with 82 per cent polymorphonuclears shortly before surgery. The possibility of pelvic abscess from perforated diverticulum was discussed. Proctoscopy was advised but not carried out. This death at least partially rests on the doctor's shoulders. It is easy to make diagnostic errors—but all diagnostic means at hand should be made use of, particularly in a poor risk patient.

The last patient died on the sixth postoperative day of uremia following anterior and posterior repair and vaginal hysterectomy. The patient had a blood pressure of 160/100 and a two plus urinary albumin before surgery. Kidney function was not evaluated. The patient was in the hospital for four days before surgery. The exciting cause of death is the responsibility of the doctor.

Comment

In any major surgical procedure, there are a multitude of important factors to be considered. The age of the patient, the state of nutrition, the preoperative diagnosis, the innate general resistance of the patient for which there are no good criteria, etc. However, there are some factual criteria upon which we can rely. These criteria have been outlined and their relative importance shown in this small series. An additional factor, cauterization of the cervix, is found to be a very important factor in preventing morbidity. The mechanism by which

cauterization of the cervix so decidedly affects morbidity is not exactly known. Perhaps it is a sterilization of the cervix and endocervix. Perhaps it is a sealing of the lymphatics and blood vessels to prevent spread of infection into parametrial tissue.

Particular stress is to be placed upon "incomplete surgery," especially in pelvic inflammatory disease. Too many practicing gynecologists have reopened abdomens with lower midline incisions that have had one tube or a part of one ovary, etc., removed at a previous pelvic laparotomy. It is desired that more complete and satisfying surgery be done if the abdomen is opened at all. If the chronic inflammatory disease is serious enough to warrant abdominal exploration, hysterectomy and bilateral salpingectomy should be done if diagnosis is correct.

The total morbidity was found to be 20 per cent—mortality 1.03 per cent. Cautery to the cervix, a normal blood count, and urine are found to be very important to the patients' welfare. Appendectomy is shown to raise morbidity slightly.

Conclusions and Summary

1. More attention should be paid to factual information pertaining to the patients' preoperative condition before major surgery.

2. The type of operation performed must not be made a routine. Every patient must have what is the best surgery possible under the sustaining conditions.

3. We learn not by discussing successes, but by carefully evaluating mistakes and then acting accordingly.

4. If the abdomen is opened, more complete surgery should be done.

5. Complete and careful evaluation of kidney function must be carried out in patients undergoing extensive vaginal plastic procedures.

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SUCCESSFUL TREATMENT OF HYDRAMNIOS WITH AMMONIUM CHLORIDE

A Preliminary Report

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HYDRAMNIOS constitutes a serious obstetric problem for which there has been no adequate treatment. The usual procedure in such cases is watchful waiting until the condition has progressed to a stage where intervention cannot be avoided. Since, in the majority of patients with hydramnios, this condition occurs in the sixth to eighth month of pregnancy, it is frequently impossible to bring about delivery of a viable fetus. A large proportion of these offspring are monsters, and the others are likely to have some less severe physical or mental handicap. Hence the prognosis generally, so far as the child is concerned, is very poor, both for life and for health.

In view of these facts, we have investigated the properties and effects of various diuretics in the hope that one could be found which might be used in hydramnios with beneficial results both for mother and for child. Ammonium chloride was selected, and in cases of hydramnios in which it has been used, it has brought prompt relief to the mothers, with no toxic manifestations; and they have been able to deliver viable, normal fetuses.

Two cases can be reported in detail at this time, since one of us (A. A. A.) is on active military service, and hence has no access to records of several patients treated successfully at the Boston City Hospital. These patients with hydramnios were treated in the sixth month of pregnancy, and they were delivered of normal infants at term.

CASE 1.—A white woman, aged 23 years, para 0, gravida i, had had an average weight of 119 pounds. Her last menstrual period occurred April 8, 1940, and confinement was expected Jan. 15, 1941. During the first trimester she had experienced mild nausea and vomiting. Physical examination at her visit on July 16, 1940, revealed no abnormal findings. The uterus was anteriorly situated, symmetrical, and enlarged to a size consistent with a three months' pregnancy. The blood pressure was 120/80, and the pulse rate was 80 per minute. Urinalysis and vaginal smear were normal.

On Oct. 7, 1940, the patient's weight was 132 pounds. This was regarded as excessive, and a salt-free diet was prescribed. Three weeks later (October 28) she appeared and felt very well. She had experienced no nausea or vomiting, bowel evacuations were normal and regular, and she had no edema. The patient weighed 138½ pounds. Her blood pressure was 120/80. The fetus was active. However, at this time, abdominal enlargement was comparable with that of an eight months' pregnancy. The question was raised as to whether there might be twins to account for the enlargement, but only one fetus was palpated and only one fetal heartbeat was heard. Hydramnios was suspected because of the tenseness of the abdomen.

On Nov. 12, 1940, the uterus still was as large as that of an eight months' pregnancy, and the patient weighed 143 pounds. The abdomen was tense, but there was no evidence of dependent edema. The blood pressure had not changed,

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and urinalysis remained normal. A diagnosis of hydramnios was made. Roentgenographic examination disclosed that the outline of the fetal skeleton could be distinctly visualized. The head was presenting and the small parts were in the right side of the abdomen. There was no apparent disproportion between the fetal skull and the maternal pelvis. The uterus was markedly enlarged, consistent with hydramnios.

Ammonium chloride was prescribed at that time. The dosage was 90 grains daily, administered in enteric-coated tablets. Four tablets (7½ grains) were given after each meal for seven days, beginning on November 15. Ten days later, the abdomen was less tense and had the appearance of a seven and one-half months' pregnancy. The weight was reduced to 138 pounds. The patient was observed at weekly intervals thereafter; blood pressure and urine did not change. The urinary output was in excess of the intake.

On Jan. 13, 1941, the patient entered the hospital at 2:00 A.M. After an enema, labor progressed rapidly, with delivery by perineal forceps at 4:31 A.M. A normal male infant weighing 7 pounds was born. Both mother and child are normal in every respect at the present time, more than four years later.

CASE 2.—A white woman, aged 24 years, para 0, gravida i, whose average weight had been 105 pounds, experienced her last menstrual period on July 7, 1943. Confinement was expected April 21, 1944. The menarche had occurred at the age of 13, the cycle was twenty-eight days, and menstrual flow lasted six days. The flow was moderate, and the patient had had no clots and no pain. Aside from several orthopedic operations for a foot deformity, she had been in good health. The uterus was slightly enlarged, in good position, and there was slight softening of the body, with a presumptive diagnosis of pregnancy on her first visit, Sept. 10, 1943. The remainder of the physical examination revealed essentially normal findings. Pelvic measurements were within normal limits. Urinalyis and serologic tests were negative, and the blood pressure was 120/80.

When the patient was seen on Dec. 14, 1943, during the fifth month of pregnancy, the uterus was enlarged far beyond the normal growth at this stage. The uterus was about 5.5 centimeters above the umbilicus and was tense. The fetus could be palpated, but appeared small. The blood pressure was 115/80, and the patient weighed 121 pounds. Urinalysis was within normal limits. Hydramnios was suspected and a roentgenographic examination was carried out. This revealed a five and one-half months' fetus with a breech presentation in both the anteroposterior and the lateral views. The uterus was enlarged out of proportion to the size of the fetus, reaching to the level of the lower border of the second lumbar vertebra, indicative of hydramnios. One week later (Dec. 24, 1943), the uterus was palpated about 6 centimeters above the umbilicus, and was extremely tense. A salt-free diet with a saline purgative was prescribed. On Dec. 30, 1943, the uterus was still very tense, and the size was fractionally increased. On January 6, the patient's weight was 124 pounds, the blood pressure 110/80, and the urine showed 1 plus albumin. A week later, the uterus was over 7 centimeters above the umbilicus, and urine albumin had increased to 2 plus. The blood pressure was 120/85, and weight was 123¼ pounds.

At this time the patient received 15 grains of ammonium chloride (two enteric-coated tablets per dose) every three hours, i.e., about 75 grains a day. This produced marked frequency of urination. The ammonium chloride was discontinued a week later (Jan. 20, 1944), at which time the patient's weight was 123 pounds, the blood pressure was 120/80, and urinalysis yielded negative findings. The height of the uterus was markedly decreased to within 2 centimeters above the umbilicus. The fetal parts could be palpated well, and the head was presenting.

The patient was seen every two weeks thereafter. Her progress was entirely normal. The blood pressure remained at 120/80; the weight increased gradually

to 132½ pounds, and all urinalyses were negative. She entered the hospital on March 30, 1944, and was delivered of a normal infant weighing 5 pounds after a four-hour labor, by low forceps and right mediolateral episiotomy. Anesthesia was produced by perineal infiltration of 1 per cent procaine and pudendal block, because of a recent upper respiratory infection. The patient's postpartum course was uneventful, and she was discharged in the usual time. Nine months later, the child appeared normal in every way, and the mother's health was excellent.

Discussion

The exact source of the liquor amnii is not known, and hence a scientific explanation for polyhydramnios cannot be given. According to DeLee,[1] it occurs about once in 200 cases.

From the experiments of Schechter, Carey, Carpentieri, and Darrow,[2] in which they demonstrated that when a watery solution was placed within the peritoneal cavity that it tended to assume the composition of a fluid in ionic and osmotic equilibrium with blood plasma, we can assume such an ionic and osmotic equilibrium for the excess accumulation of fluid within the amniotic sac.

Upon this fluid ammonium chloride acts by producing an increase in titratable acidity of the urine, producing a rise in urinary ammonia, and an increase excretion of fixed base. According to Gamble, Blackfan, and Hamilton[3] the diuretic action of ammonium chloride depends upon an increased acidity of the body fluids. The change in the reaction is of such a degree that it must, according to the terms of the Donnan equilibrium theory, considerably alter osmotic pressure values in the body fluids, and these alterations may reasonably be suspected as the factors involved in the removal of the body water.

We are also using ammonium chloride effectively in all stages of pregnancy, in those cases in which there is excessive gain in weight, with or without noticeable edema. In these cases, the resultant weight loss is pronounced. So far as we can determine, there has been very little use of this valuable drug during pregnancy. The results we have observed certainly suggest that this mode of treatment should receive much wider clinical trial in any condition in pregnancy in which there is undue gain in weight, or any possibility of hydramnios. A more extensive report of our experiences, along with a detailed study of the selective fluid accumulation in hydramnios and the beneficial effects of ammonium chloride, will be presented later.

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SARCOMA OF THE VAGINA*

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THE presence of primary sarcoma of the vagina is fortunately rare, for it carries with it a most grave prognosis. We are presenting at this time the only two cases of this type found at the University of Maryland during the past ten years, and during which time there were 8,589 gynecologic admissions. This incidence seems to tally fairly well with that reported by Lynch from the University of California, where he found one case of vaginal sarcoma among the last 4,000 gynecologic cases.

In 1935, McFarland presented a most complete and exhaustive treatise on the dysontogenetic and mixed tumors of the urogenital region. In this he made some reflections on the nature of sarcoma which are well worth quoting. The term, sarcoma, derived from the Greek, literally means "fleshy swelling" or "lump of flesh." The term, though used generally, is given a different interpretation by clinicians and pathologists. However, both groups will agree on the following fundamental principles: (1) sarcoma is a malignant tumor; (2) it occurs chiefly in the young; (3) it consists essentially of cells; (4) the cells are of mesoblastic origin; (5) the cells are of embryonal type; (6) they represent the early form of the connective tissues.

Many of the vaginal sarcomas that have been reported in the literature arise in childhood and are most commonly of the botryoid type. The first case report of this tumor was made by Gersant in 1854. In 1911 McFarland reviewed the literature and tabulated 44 cases of vaginal sarcoma in children, 34 of which were botryoid, and the remaining 10 were classified as miscellaneous; 86 per cent of these 44 cases occurred during the first three years of life, and the remaining were found before the sixth year.

Vaginal sarcoma in the adult, like that in childhood, is an extremely rare entity. McFarland could collect only 58 cases. The adult sarcoma occurs in two forms, parietal and mucosal. The infiltrating parietal type is the more common.

As has been stated, the more common of the vaginal sarcomas of childhood is the botryoid type. This tumor derives its name from its chief gross characteristic, that of appearing in grapelike clusters. The anterior vaginal wall is the most common site of this lesion. It is here that McFarland found approximately 50 per cent. The posterior and left lateral vaginal walls are the next most common sites of origin. The tumor is friable, bleeds easily on manipulation, and has a tendency to become necrotic and slough. The growth is rapid, the tumor mass soon fills the entire vagina, and presents itself at the introitus as a polypoid mass of necrotic tissue. The tumor extends by continuity of tissue until, in a relatively short time, the entire pelvis is completely filled with a conglomerate mass comprising the tumor and the involved adjacent organs, i.e., vaginal vault, posterior surface of the bladder, and in its terminal stages, the rectum and the anus. The internal generative organs are involved with neoplastic tissue, which probably represents local extensions rather than lymphatic metastasis. Various authorities agree that sarcoma of the vagina in children is a mixed tumor and develops from misplaced embryonal, mesodermic cells. Microscopically, the tumor is composed of an edematous, myx-

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omatous stroma through which are dispersed, in varying degree, spindle and stellate cells. The nuclear activity varies from field to field; in places there will be little or no cellular activity, while other portions of the same slide will show hyperchromatic nuclei and innumerable mitotic figures. Occasionally, multinucleated giant cells are seen. Some sections will show marked vascularity, while other areas will show tissue necrosis, probably resulting from deficient blood supply. The surface of the tumor microscopically shows the characteristic changes associated with secondary infection, round cells, plasma cells, and polymorphs.

Some authorities contend that, due to its embryonal nature, botryoid sarcoma is present at birth, but is overlooked until the development of symptoms. A bloody vaginal discharge is usually the first symptom. This is frequently associated with pain and itching of the vulva and vagina. As the condition progresses, pain becomes more intense because of pressure. The pelvic mass first encroaches upon the bladder, resulting in frequency, incontinence, and infection. Quite frequently hematuria develops and indicates involvement of the bladder mucosa. With the posterior migration of the process, the rectal lumen becomes constricted; tenesmus, increasing constipation, and rectal bleeding are the natural result. Occasionally, complete intestinal obstruction ensues, with the usual signs and symptoms. Cachexia, anemia, and edema of the lower extremities appear as terminal findings. Death usually results from a combination of toxemia, uremia, and exhaustion. It will be noted from the preceding description that all symptoms are the result of local extension. Distant metastases are extremely rare, the lung and kidney being the only two sites reported in the literature.

Approximately 20 per cent of the tumors of childhood are not botryoid in type. Little is known of these miscellaneous tumors, since only ten have been reported in the literature. The gross and histologic pictures presented by these miscellaneous tumors are variable, but fundamentally resemble the adult type of vaginal sarcoma, which will be discussed later. The symptomatology of these miscellaneous tumors varies with the rapidity and extension of growth, while the prognosis is concomitant with that of the botryoid type.

CASE 1.—The first case which we wish to report represents a classical example of sarcoma botryoides. The patient is a 21-month-old, white, female child, admitted Sept. 19, 1939, to the gynecologic service at the University of Maryland. The chief complaint on admission was vaginal bleeding of three months' duration. The patient developed normally until, at the age of 18 months, the mother first noticed small clots of blood passing from the vagina. The child exhibited no other symptoms or signs, and medical attention was not sought for approximately two months. On the advice of the family physician the child was hospitalized at the Washington County Hospital, at Hagerstown, Maryland. Several small tumors were removed from the vagina which histologically proved to be sarcomatous. The postoperative course was uneventful, but vaginal bleeding occurred in three weeks. It was then that the patient was first referred to the University of Maryland Hospital for further study and treatment, since the facilities for radiation therapy were lacking at Hagerstown. The remainder of the history was entirely negative and indicated no familial tendency toward malignancy. General physical examination at the time of admission was essentially negative, and there was no evidence of weight loss or anemia. Examination of the pelvis showed the vulva to be normal. Protruding from the vaginal outlet was a small, polypoid mass apparently arising from the right lateral wall, near the right fornix. The remainder of the pelvic organs, as far as could be determined, were not involved at this time. Laboratory examination shortly after admission showed a hemo-

globin of 85 per cent and a red count of 4.5 million. The white blood count at this time was 5,250, with a normal differential. Routine serologic and urine examinations were negative. Cystoscopic examination showed no malignant invasion of the bladder. X-rays of the chest and pelvis showed no abnormalities.

On Sept. 21, 1939, the bulk of the growth was removed. (See Figs. 1 and 2.) Approximately one week later the remainder of the mass was excised and two 50 mg. plaques of radium were applied to the base. The radium remained in place for ten hours, giving a total dosage of 1,000 milligram hours.

Two months later a new growth had appeared on the posterior vaginal wall, with multiple small implants throughout the vault of the vagina. The growth originating on the right lateral wall appeared fibrotic and to be healed. The tumor masses were excised at this time but, because of the possibility of rectovaginal fistula, further radiation was contraindicated. Therefore, the patient was started on a course of deep x-ray therapy; a total of 2,072 "r" units was given through the four pelvic portals.

Approximately two months after the completion of x-ray therapy, the local growth showed good response, and there was no evidence of extension of the process. However, eleven months after the appearance of the first symptom, the child was readmitted for her terminal hospital stay. Symptoms reappeared approximately three weeks before this admission, consisting of anorexia, constipation, dysuria, and vaginal bleeding and discharge. Examination at this time showed marked anemia, lassitude, and moderate weight loss. The lower abdomen was distended by a mass arising from the pelvis and reaching almost to the umbilicus. Inguinal nodes were palpable for the first time. A greenish, fungating mass protruded from the vagina, associated with a profuse, foul vaginal discharge. Rectal examination confirmed the impression that the abdominal mass arose from the pelvis. On this admission there was a marked anemia and leucocytosis. The urine showed a three plus albumin and innumerable white and red cells. Supportive treatment, consisting of parenteral fluids and repeated small transfusions, was of no avail. Progress was rapidly downhill and respirations ceased at 11 A.M. on May 23, 1940, less than one year after the onset of the first symptom.

Autopsy—8340—myxosarcoma of the vagina. Necrosis and destruction of the base of the bladder. Cystitis. Hydro-ureter. Hydronephrosis. Pyelitis. Malignant infiltration of right pelvic wall. Emaciation. Dehydration. No remote metastases. (See Figs. 3 and 4.)

In contrast to the sarcoma of childhood, adult vaginal sarcoma is rarely botryoid in type, but, like the childhood tumor, the two adult forms derive their name from their predominant gross characteristic: the parietal, so named because it takes its origin from beneath the basement membrane, and the mucosal type, which involves the vaginal epithelium. The parietal type is the more common variety of adult vaginal sarcoma. The growth spreads beneath the vaginal mucosa and infiltrates the surrounding tissue. As the tumor gradually enlarges, pressure necrosis of the overlying vaginal epithelium occurs. This local extension, however, is less rapid than with sarcoma botryoides, so that the pelvic organs are not involved by the malignant process until much later. In comparison, the mucosal type, arising from a relatively small base, soon erodes through the vaginal mucosa and presents itself as a soft, necrotic tumor mass. The slough from this ulcerative, fungating mass causes symptoms to develop more rapidly, and for that reason patients with the mucosal type of tumor are usually diagnosed at an earlier clinical stage.

Microscopically, the two types of adult vaginal sarcoma cannot always be differentiated. At times the picture is classically that of a mixed tumor, while occasionally it is purely a matter of opinion. Typically, adult vaginal sarcoma

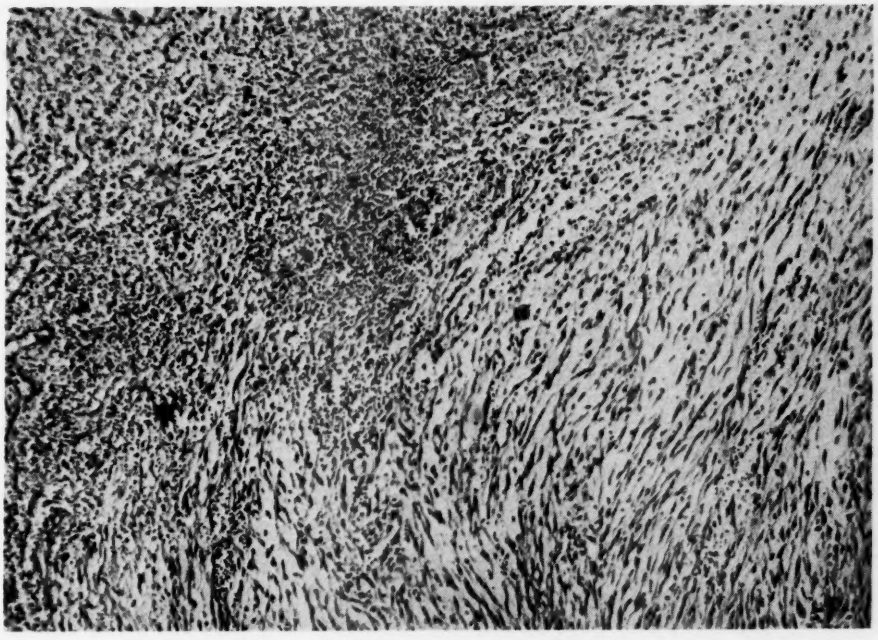

Fig. 1.—Sarcoma botryoides before therapy (low power).

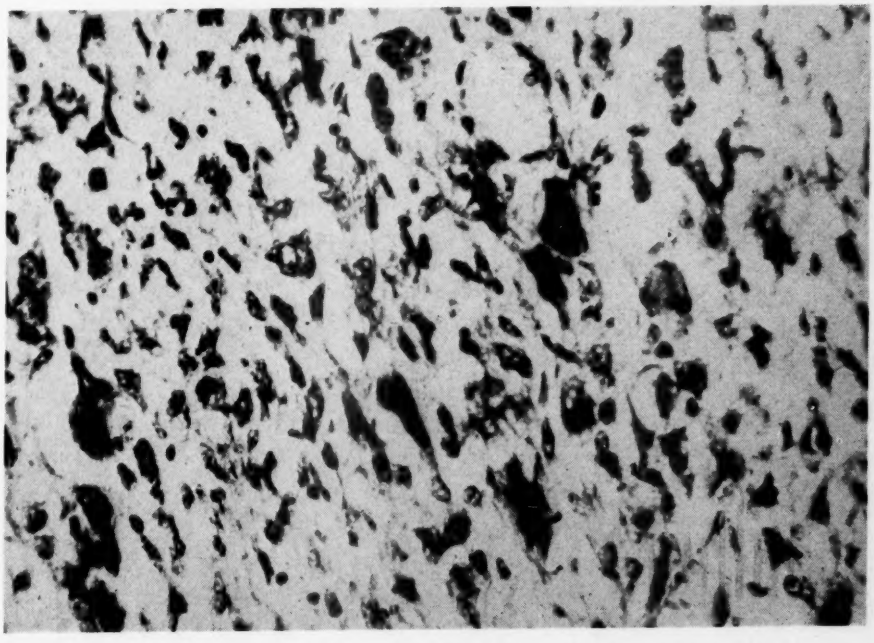

Fig. 2.—Sarcoma botryoides before therapy (high power).

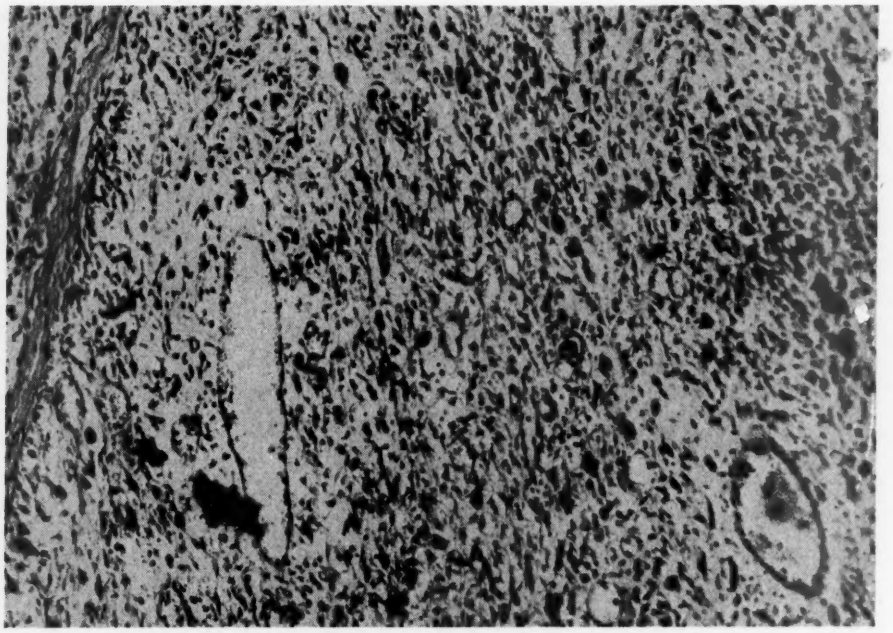

Fig. 3.—Sarcoma botryoides after therapy, autopsy section (low power).

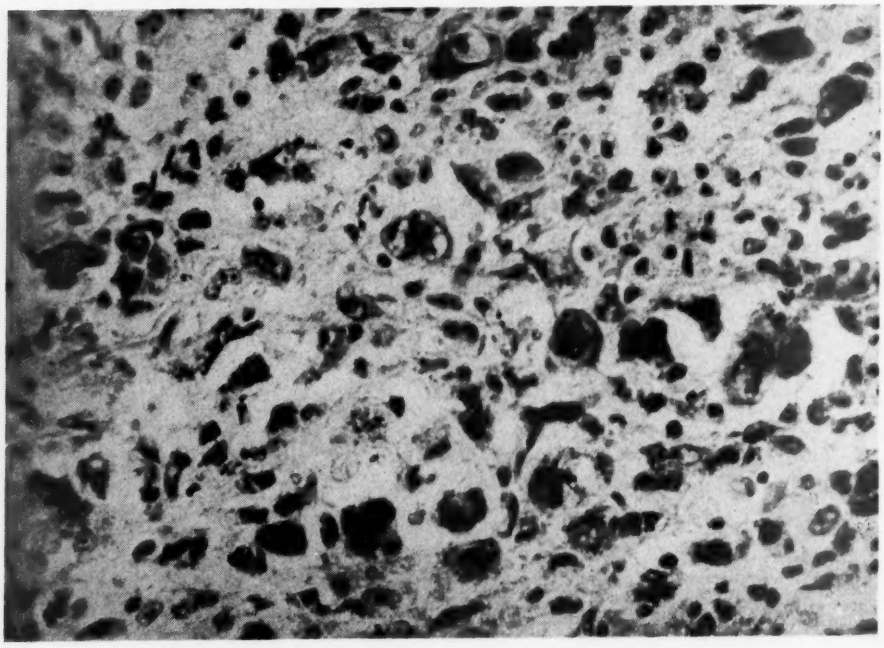

Fig. 4.—Sarcoma botryoides after therapy, autopsy section (high power).

consists of bundles of spindle cells dispersed through a highly vascular stroma. The cells are quite uniform in size and shape; mitotic figures and hyperchromatic nuclei are moderately numerous. Tumor necrosis is usually present with the associated appearance of secondary inflammatory cells.

From the gross description of the lesions, it is obvious that the symptoms, while similar, will occur earlier with the mucosal variety. Chronologically, they appear as a vaginal discharge which soon becomes malodorous. As ulceration takes place, bleeding occurs, usually first noted and more profuse following trauma. As the infiltration of the vesicovaginal and rectovaginal septa progresses, the classical bowel and bladder symptoms ensue. The subsequent sequence of events, though less rapid, is identical with that of sarcoma in children, and ultimately terminates in toxemia and death. Symptoms resulting from distant metastases are somewhat more common than those found in the childhood type. Lung, kidney, omentum, liver, and long bones have all been reported as a site of metastatic lesions.

CASE 2.—The presentation of a typical recent case of adult vaginal sarcoma follows: this patient, a 40-year-old Negro woman, was admitted to the gynecologic service July 23, 1945, with a chief complaint of a "sore" in the vagina and lower abdominal pain of eight weeks' duration. The patient was apparently well until two months prior to admission, when she first noted a tender, hard area within the vagina. There was some vaginal discharge and slight bleeding on trauma. There were no other subjective symptoms, excepting moderate discomfort in the lower abdomen, suggestive of recurrent chronic salpingitis. Both the family and past history were entirely negative. The patient had had no serious illnesses or operations. The review of systems was negative, as was the menstrual history. The patient was married but had had no pregnancies, although there was a vague history of a spontaneous abortion in March, 1945.

General physical examination revealed a moderately obese Negro woman, without evidence of anemia or weight loss. Examination of breasts and abdomen was entirely negative. There were no palpable inguinal nodes. Pelvic examination revealed the external genitals normal and the outlet marital, with good support. On the right anterolateral vaginal wall, about mid-distance between the introitus and cervical portio, was found a walnut-sized, round, granular lesion. The growth measured 3¼ cm. in greatest diameter, and the exposed surface was covered with a grayish white exudate. Induration was present in the submucosal tissue surrounding the elevated portion of the lesion. This was more marked anteriorly, where it extended almost to the base of the urethra. The cervix was small, firm, entirely separate from the vaginal growth, and there was no erosion or malignancy on inspection. The uterus, tubes, and ovaries were normal. Rectal examination showed no evidence of parametrial extension.

Laboratory investigation of the blood, made during hospitalization, indicated that all cytologic and chemical constituents were within normal limits. Liver and renal function tests showed no evidence of impairment. Complete x-ray studies revealed no osseous metastases. Cytoscopy showed no evidence of extension.

On the seventh day after admission, the following operative procedure was carried out on the previously described lesion. A portion of the growth was removed in such a manner that a flat surface remained. (See Figs. 5 and 6.) Against this was placed a plaque containing 100 mg. of radium, with a 3 mm. lead equivalent filter; this plaque was held in position with one vaginal pack and remained in place for thirty hours, giving a total dosage of 3,000 milligram hours. The postoperative course was entirely uneventful and the patient was discharged to the Oncology Clinic after a hospital stay of seventeen

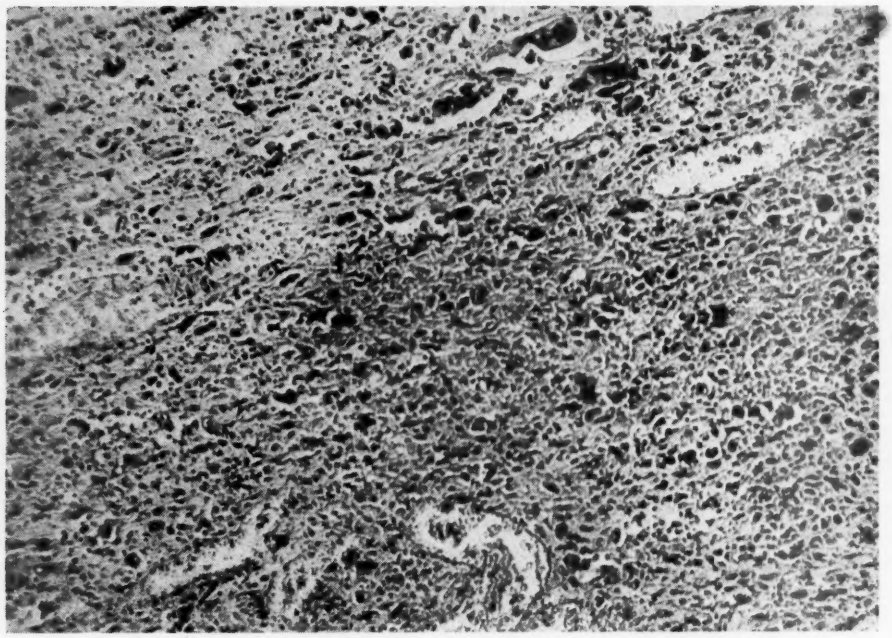

Fig. 5.—Fibrosarcoma before therapy (low power).

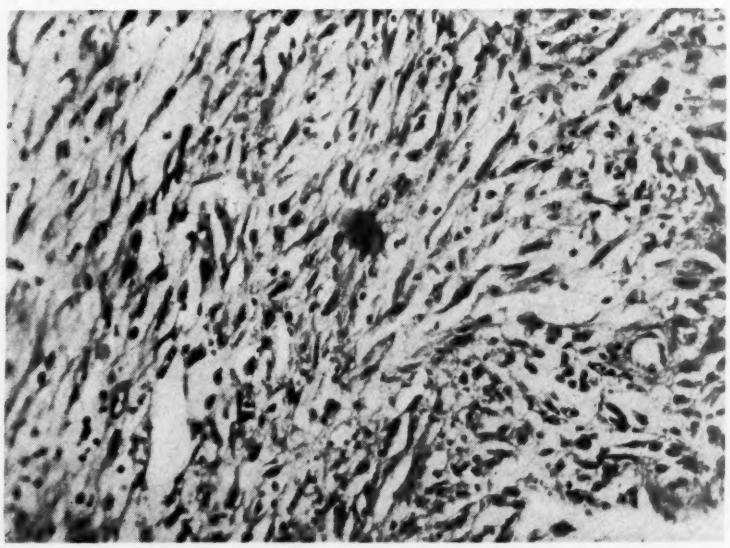

Fig. 6.—Fibrosarcoma before therapy (high power).

days. Since discharge from the hospital, the patient has returned frequently for follow-up examinations. At these times it has been noted that there is a gradual local regression of the growth, and no evidence of further extension.

Comment

The treatment of sarcoma of the vagina is most discouraging. Because of its extremely malignant nature and rapid growth, the tumor is soon beyond the realm of favorable response to surgery or/and radiation. Since all types of vaginal sarcoma consist of the same histologic elements, the treatment is fundamentally the same, but, because of the rarity of this condition, no uniformity of treatment has been established, and each case presents a problem in therapeutics. Surgery, electrosurgery, and radiation are the means available for the treatment of these malignant tumors, and usually are combined in the management of any specific case. Excision is most certainly indicated in the botryoid tumor where the entire vagina is filled with grapelike clusters. This procedure at times is difficult because space is limited and exposure inadequate. The pedicle is extremely vascular, and hemorrhage is always a potential danger. In spite of these apparent contraindications, the procedure must be undertaken in order to make the base accessible for radiation therapy. Electrosurgery is often the procedure of choice, especially when ligation of individual bleeding points is impossible. The total extirpation by either surgery or electrosurgery is usually impossible, due to the inaccessibility of the growth, occasioned by its rapid migration. The excision of local recurrences is indicated, particularly in the presence of ulceration, bleeding, and secondary infection.

Since sarcomas in general are radiosensitive, vaginal sarcomas theoretically should respond if all the cells could be brought within the effective sphere of the ray. As has been previously described, the base of the tumor must be adequately exposed in order that it may be amenable to the application of a radium plaque. The plaque usually consists of 100 mg. of radium, and is made to conform to the size and shape of the lesion. The plaque itself is so constructed that the rays from each of the five separate cylinders are directed against the growth. The surrounding structures are protected by a lead shield, and the irritating rays are eliminated by a 3 mm. lead equivalent filter. A large vaginal pack is used to maintain the plaque in its original position, and at the same time it distends the vagina and further protects the bladder and rectum from the radium rays. In order to avoid the possibility of stricture, the radium is employed in two or three divided doses, each of them from 1,000 to 3,000 milligram hours.

Roentgen therapy is often used as an adjunct to surgery and radium, and in these cases the total dosage of deep x-ray depends upon the local response. The x-ray is given in divided doses through the usual pelvic portals.

The time interval between the three different types of therapy must be based upon the therapeutic response to each phase of treatment.

Local recurrences of the growth should in general be handled in the same manner as the original lesion.

Summary and Conclusions

Sarcoma of the vagina, like sarcoma in general, is a highly malignant tumor of mesoblastic origin. It is classified in two main types, childhood and adult. The botryoid is the more common childhood form, while the parietal is the more common adult variety.

The progress of the disease is rapid, and the signs and symptoms are the result of local extension.

Complete surgical excision is usually impossible and, while the tumor is radiosensitive, recurrences rapidly develop.

The prognosis is uniformly poor, and the diagnosis is open to question in any case which survives more than two years.

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11 EAST CHASE STREET

HYDATIDIFORM MOLE, WITH SPECIAL REFERENCE TO RECURRENCE AND ASSOCIATED ECLAMPSIA

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WE HAVE encountered in our clinic an unusual case of recurrent hydatidiform mole complicated each time by severe toxemia, which has stimulated us to analyze all of our "mole" cases and to review certain aspects of the literature. In the present paper, we shall give:

1. A case report—hydatidiform mole with severe pre-eclampsia, followed by three normal pregnancies, and then another mole with eclampsia and a subsequent chorionepithelioma, despite negative Friedman tests.

2. A review of the literature on recurrent hydatidiform mole.

3. A review of the literature on eclampsia associated with hydatidiform mole.

4. An analysis of 57 consecutive cases of hydatidiform mole, with follow-up studies on all.

Case Report

First Pregnancy.—B. B., history No. 3409, aged 22 years, gravida i, para 0, came into the clinic on Feb. 23, 1932, in the third month of pregnancy. She complained of marked edema of the extremities of two weeks' duration. She had dyspnea on slight exertion, hemoptysis, and vaginal spotting. Her weight was 117 pounds; blood pressure, 180/130; 4 plus proteinuria; with marked edema to the hips and of the arms. The abdomen was flat, and the fundus was 11 cm. above the symphysis. She was admitted to the hospital at once, and during the next six weeks maintained the hypertension and proteinuria. The edema became generalized and then cleared up under dehydration therapy, with a weight loss of 18 pounds. A transfusion was given because of anemia (red cell count of 3,060,000). On x-ray examination, the heart appeared to be generally enlarged. The optic fundi showed white patches and silvery arteries. The urinary specific gravity varied from 1.003 to 1.016; numerous hyalin and finely granular casts were a constant finding. The two-hour excretion of phenolsulfonphthalein was 40 per cent, with none appearing by the end of the first thirty minutes. The blood nonprotein nitrogen and uric acid were normal at all times. After six weeks in the hospital, she spontaneously expelled a hydatidiform mole, following which the uterus was digitally curetted.

After expulsion of the mole, the blood pressure dropped, although it remained at 140/90 to 100 for several weeks before falling to normal levels. The proteinuria cleared up rapidly, but reappeared sporadically during the next three months. The uterus involuted slowly, and was still slightly enlarged three and one-half months later. The left ovary, which had been enlarged, regressed with equal slowness.

The Friedman test was negative two weeks after extrusion of the mole, but became positive three months later. Because of two positive tests, in the absence of probability of pregnancy, a diagnostic curettage was done. The pathologist's report on the curettings was "chronic endometritis." Recovery was smooth.

Second Pregnancy.—Uneventful. Blood pressure range 112/72 to 135/85; no proteinuria or edema; total weight gain was 14 pounds. Delivered Dec. 21, 1933, of a living child at forty-two weeks. The placenta was adherent to the site of the previous molar implantation, and was removed manually four hours after delivery. The blood loss was estimated at 900 ml., and the patient went into shock which was successfully treated. Febrile morbidity occurred for the first seven days, and then a normal puerperium.

Third Pregnancy.—Uneventful. Blood pressure range 110/60 to 120/76; no proteinuria, slight pretibial edema when near term, total weight gain again 14 pounds. Delivered March 25, 1936, of a living child at forty-one weeks. Normal puerperium occurred.

Fourth Pregnancy.—Central placenta previa and cesarean section at thirty-four weeks, Sept. 8, 1937. Blood pressure range 86/62 to 125/65. No proteinuria; no edema; total weight gain, five pounds. Baby survived, and the mother's convalescence was smooth.

Follow-up, Nonpregnant.—In April, 1940, her blood pressure was 122/76; urea clearance was normal; heart was not enlarged; eyegrounds were normal.

Fifth Pregnancy.—Patient came into the clinic Aug. 19, 1940, with an amenorrhea of fourteen weeks, and complaining of a brownish vaginal discharge, nausea and vomiting of six weeks' duration, and a weight loss of 18 pounds. The uterus was unusually soft, the size of a four and one-half months' pregnancy. No fetal heart, movement, or parts could be made out. Friedman tests were positive in urine dilutions as high as 1 to 9,000, and in spinal fluid diluted 1 to 200. The blood pressure was normal, and there was no proteinuria or edema; red blood count was 3,900,000, and basal metabolic rate, plus 44 per cent.

In the second week of hospitalization, the patient gained 5 pounds; edema appeared; the blood pressure mounted to 170/110, and later to 206/140. Proteinuria appeared and rapidly increased to as much as 30 Gm. per liter. The blood uric acid rose steadily from 4.2, and ultimately reached 8.5 mg. per 100 ml. On the nineteenth hospital day, she had five eclamptic convulsions. When these had been controlled, a bag was inserted to induce labor, and about fifty hours later a large hydatidiform mole was expelled. Remnants of the mole were removed digitally. Blood culture taken at the time of an intrapartum chill showed anaerobic streptococci. In the first four days of the puerperium, the patient ran a septic course, and received multiple small transfusions. Thereafter, the convalescence was smooth. The Friedman test was positive in half strength on the eighth day, in full strength on the fifteenth day, and negative on the twenty-second day.

Five weeks after the delivery of the mole, the patient began to have intermittent pain in the left lower quadrant, at first with slight vaginal bleeding and passage of clots, and then with profuse hemorrhage. She was readmitted in mild shock. An exquisitely tender mass (cystic ovary on a twisted pedicle) was palpated at the site of the pain. After anti-shock therapy, a diagnostic curettage was done. The pathologic report was "atypical chorionepithelioma." After further transfusions, complete hysterectomy and bilateral salpingo-oophorectomy were done. The uterus was twice the normal size; the left ovary was replaced by a cyst weighing 180 Gm.; the right ovary was smooth, cystic, and completely degenerated. The uterus showed a single nodule of chorion-epithelioma. Recovery was uneventful.

At follow-up ten months later, the patient was in good health. The blood pressure was 118/70; no proteinuria was present; the urea clearance was 86 per cent. She, together with her entire family, was killed in an automobile accident the day after leaving the hospital.

In recapitulation, the patient had a hydatidiform mole in her first pregnancy. This mole was accompanied by severe pre-eclampsia. Three months later, the Friedman test became repeatedly positive, after having been negative. No reason was ever found for this. She then had three pregnancies without mole and without toxemia. Two of these were characterized by anomalous placentation. The fifth pregnancy was again molar, and with this mole she had eclampsia. Five weeks after the mole was expelled she developed signs of chorionepithelioma, which diagnosis was confirmed. The Friedman test was negative at three weeks, and only weakly positive at five weeks, despite the presence of the neoplasm. Cystic ovaries occurred with both of the moles. The patient was followed in all of her pregnancies, between pregnancies, and until her accidental death.

Review of the Literature

Recurrence of Hydatidiform Mole.—There seems to be no estimate in the literature as to the frequency of recurrence of mole. Several series of 50 to 100 or more cases have been published, with no instance of recurrence in these consecutive cases. Mathieu[26] analyzed a series of 127 cases pooled by the Pacific Coast Obstetrical and Gynecological Society over a five-year period. One of these patients gave a history of having had an earlier mole. There were 16 patients having subsequent pregnancies, and one of these had simultaneously another mole and chorionepithelioma. It is not clear whether one patient is involved twice in this account, or whether there were two patients having repeated moles. Holman[18] surveyed the cases of the following five years. By coincidence, there were agan 127 patients, of whom one gave a history of an earlier mole. Brews[5] reviewed the 100 cases of hydatidiform mole occurring in a 33-year period at the London Hospital. Only one of these gave a history of previous mole, and none had a subsequent mole. Jeffreys and Graffagnino,[19] in a series of 28 cases, saw one patient who had two moles, and one who had three. In the 13-year experience of the Margaret Hague Maternity Hospital, there have been 57 cases of mole, with only one recurrence (case report). None of the 56 patients gave a history of having had an earlier mole elsewhere.

Essen-Möller,[11] in 1912, reviewed the literature and found 10 case reports of recurrent mole, to which he added two cases of his own. Since there seems to be no more extensive review than his, we have made a rather thorough search for case reports of repeated mole. Our procedure was to look through the *Index Medicus* from 1879 to date, the *Index Catalogue of the Surgeon General's Library* from 1880 to date, and the *Berichte über die gesamte Gynäkologie und Geburtshilfe* from 1924 to date. Also, we looked through the general indices of many journals, especially the German. We then gained access to the papers with titles suggesting that the subject matter might be concerned with molar pregnancy in relation to (a) recurrence, (b) toxemia, and (c) analyses of large series of cases. Also, we have consulted publications cited in the bibliographies of papers germane to our subject, whenever they could be found.

We shall first cite chronologically the papers which we have actually seen; to these may be added three which were not found. Still other references will be discussed and rejected.

Seventeen (or 18) women having *two* moles have been reported by van Deurs,[9] Bloch,[2] Puech[32] (two cases), von Winckel[39] (not four moles as stated by Essen-Möller—the author writes that the first and third pregnancies terminated as blood moles, while the second and fourth were hydatidiform moles), Williamson,[38] Findley,[12] Essen-Möller,[11] Muggia,[28] Cipriani[7] (doubtful case), Guiroy,[14] Pascale[31] (first mole complicated by eclampsia), Mathieu[26] (one or two cases?), Brews,[5] Sureau,[35] Holman,[18] and Jeffreys and Graffagnino.[19]

Nine women having *three* moles are recorded by Steinberger,[34] Haase,[16] Depaul,[8] Warman,[37] Buzzoni,[6] Haas,[15] Morosi,[27] Thomas,[36] and Jeffreys and Graffagnino.[19]

Three case reports have been published describing *four* moles in the same patient: Osborn,[30] Fritsch,[13] and Digonnet.[10]

Lemaire[22] described a case having *six* moles, Muggia[28] one with *seven* (third complicated by eclampsia), Mack and Catherwood[24] one with *ten,* and Essen-Möller one with *eighteen* moles. (These cases with the higher numbers are based upon the histories elicited from the patients.) Krieger[21] reported a case in which *three* consecutive pregnancies terminated in stillbirths accompanied by progressively decreasing degrees of partial molar degeneration.

In the cases cited above, the hydatidiform moles occurred in successive pregnancies, or were separated by early abortions. The interspersion of normal pregnancies between moles seems to be unusual. Harkin[17] described a case in which the first and third pregnancies were molar, while the second went normally to term. Kohn's[20] case had two normal pregnancies, a mole, then eight normal pregnancies, and finally a fatal mole. Rosenthal[33] reported a case having 11 normal pregnancies, a mole, two normal pregnancies, and again a mole. Bazán[1] reports a case in which the first three pregnancies were normal, the fourth and fifth molar, the sixth and seventh normal, and the eighth again molar. Bottiroli's[4] case is very similar: four normal pregnancies, fifth and sixth molar, seventh normal, and eighth again molar.

There are three cases cited which we have been unable to see. Lemaire[22] credits to Virchow a patient having two moles. Essen-Möller[11] refers to Hermont as having a patient with six consecutive moles. Madame Boivin[3] refers to a case of Bonus in whom three consecutive moles may have occurred within a period of a few months.

We are eliminating a group of possible cases, for the reasons given in each instance. Findley[12] referred to a case of Lönnberg and Mannheimer[23] as having a mole followed by a normal pregnancy and then another mole. (We believe that we have found the case. Findley's reference is to "Lonnberg and Mannsheimer," and the place of publication given was erroneous.) The patient did have a mole in her first pregnancy, and the second pregnancy was normal. Chorionepithelioma was found four weeks after the normal pregnancy. The writers suggested the possibility of an unrecognized mole associated with the chorionepithelioma. Since they, who managed the case, did not recognize a recurrent mole, we shall not. Both Essen-Möller[11] and Lemaire[22] (both of whose reviews of the literature have been extensively transcribed, translated, and transmuted by many later writers) wrote that Mayer had a case with 11 consecutive premature deliveries. Each baby was well formed, and accompanied by a mole. Majer[25] (variously called Maier, Meier, Major, Mayer and Meyer in different citations) did describe such a case, but writes ". . . und die sich als gewöhnliche, 12 Loth schwere Fleischmole darstellte." It is not stated that the Fleischmolen, only the last of which Majer saw, had undergone hydatidiform degeneration. Our inclination is to throw out this case, which has been cited in literally dozens of secondhand reviews of the literature. Lemaire[22] cites O. Ahsby as having a case with three moles in three years; Essen-Möller[11] says that Osborn Ashley described three moles in three years. These two citations almost certainly should be to G. Ashby Osborn,[29] who described such a case in 1864, and in 1865 reported the fourth mole in the same patient.[30] Lemaire[22] writes, "Haase, Warman et Block, Krieger, Virchow et Williamson" described cases having two moles (how many case reports here? two? six? any intermediate number?). Compare these names with some of those cited above. While "Haase, Warman et Block" looks like a single paper by three authors, Bloch[2]

did describe a case with two moles. Haase,[16] Haas,[15] and Warman[37] have each reported cases with three (not two) moles. Essen-Möller[11] attributes to "Hasse" a case having two moles, and Bazán[1] credits "Hause" with such a case. The misspelling of a name by one letter is a mere peccadillo as the bibliographies of these case reports go. Since we have cited the cases of Krieger,[21] and of Williamson,[38] as well as the three just mentioned, we believe that the only case from this welter which we do not have is that of Virchow. Muggia[28] mentions a case of "Karkin" (reference merely to "Da Naccioli") which fits in all details with the case of Harkin.[17]

In summary, then, we have found descriptions of 39 or 40 women having recurrent moles. In addition to these, we have seen citations to two cases, and possibly more. Of these 41 or 42 women, only five had normal pregnancies between moles. To this list, we add our own patient who had a mole in her first pregnancy, then three normal pregnancies followed by a recurrent mole in her fifth pregnancy.

Eclampsia in Molar Pregnancy.—We have found in the literature 35 cases of probable or alleged eclampsia occurring in association with hydatidiform mole, or with partial hydatidiform degeneration of the placenta. These are summarized in Table I. There are more papers than cases; thus one of the cases described by Hinselmann and Nettekoven[55] was earlier reported both by Schäfer[69] and by Knopp.[59] The case often credited to Olshausen[64] was described 22 years previously by Meye.[63] Chadwick's[44] case was later mentioned by Craigin,[45] to whom it was credited by Essen-Möller.[11] Another duplication is in the case described by Falk[48] and by Hillman.[54]

Hinselmann and Nettekoven[55] mention cases of Döderlein and Rosinski, but give no reference to the original reports. We have not found these, but from Hinselmann's remarks, Döderlein's case seems to check in all details with the case described by Brauser,[42] from Döderlein's clinic. We have no lead at all to Rosinski's case, unless it is the remarkable one in which eclampsia occurred with a missed abortion (no hydatidiform degeneration here, however).[75]

Westermark's[73] case, described as eclampsia, is open to serious question, since the patient had no proteinuria and the convulsions did not occur until eight and one-half weeks after the evacuation of the uterus. Raineri's[66] case had convulsions and died ten days after a spontaneous abortion, but he found molar tissue post mortem, which would make this case acceptable. Dulac's[47] patient had convulsions two and one-half weeks after the passage of a mole; however, she had continued to pass vesicles for a few days afterward, and had an offensive vaginal discharge until the day of convulsion. Dienst's[46] patient had no actual convulsion, but was comatose for three days, and had twitchings and marked proteinuria. Dienst's diagnosis was, regretfully, "Eklampsie ohne Anfall." García's[50] case had no convulsion, but postmortem examination established the presence of eclamptic changes in the liver and kidneys.

Only partial molar degeneration was present in the cases of Meye,[63] Falk,[48] Dienst,[46] Gross,[51] Jonas,[58] and Wigger.[74] In 19 cases in Table I, the definite statement is made that no fetus was present. A fetus was said to occur in seven, and in 10 no explicit statement is made, but one gets the impression that there was no fetus.

Five of the 36 cases died, a mortality of 14 per cent. This seems low when one considers the mortality rate for mole alone, or for eclampsia alone during the times when most of these cases occurred.

The ratio of primiparas to multiparas is 2 to 3. This is distinctly at variance with the ratio noted in any considerable series of eclamptics, where primiparas outnumber multiparas almost to 3 to 1.

TABLE I. CASES OF PROBABLE OR ALLEGED ECLAMPSIA OCCURRING IN CONJUNCTION WITH HYDATIDIFORM MOLE

AUTHOR	YEAR	LOCALITY	MONTHS PREGNANT	FETUS	AGE	PARITY	PREVIOUS ABORTION
Malichecq[62]	1866	Mont-de-Marsan	4 to 5	0	24	Multip.	0
Meye[63]	1869	Halle	4	Yes	34	Primip.	Yes
Parmenter[65]	1870	Michigan	?	0	53	Multip	?
Almy[41]	1882	Connecticut	4	0	?	?	?
Dulac[47]	1884	Paris	5	0	37	Primip.	0
Chadwick[44]	1890	Boston	4	0	25	Primip.	0
Falk[48]	1897	Jena	5	Yes	22	Primip.	0
Raineri[66]	1904	Vercelli	3	?	?	Multip.	?
Hitschmann[56]	1904	Vienna	5	0	18	Multip.	0
Rossi-Doria[67]	1906	Rome	4	?	30	Multip.	?
Rossi-Doria[67]	1906	Rome	3 to 4	?	21	Primip.	0
Kroemer[60]	1907	?	4 to 5	?	30	Multip.	?
Dienst[46]	1908	Breslau	4 to 5	Yes	32	?	?
Gross[51]	1909	Prague	5	Yes	22	Multip.	0
Brauser[42]	1910	Munich	5	0	34	Multip.	0
Sitzenfrey[70]	1911	Giessen	6	0	22	Primip.	0
Vineberg[72]	1911	New York	6	0	25	Primip.	0
Vineberg[72]	1911	New York	4	0	18	Primip.	1 (?)
Jonas[58]	1914	Greifeswald	7	Yes	?	?	?
Albeck[40]	1914	Denmark	?	?	30	Multip.	?
Westermark[73]	1919	Stockholm	6	0	25	Multip.	0
Muggia[28]	1920	Milan	3	?	23	Primip.	2 moles
Guggisberg[52]	1922	Berne	4	0	?	Primip.	0
Hinselmann and Nettekoven[55]	1922	Bonn	6	0	42	Multip.	0
Hinselmann and Nettekoven[55]	1922	Bonn	4	?	?	?	?
Herring[53]	1924	Pingtu	4 to 5	Yes	35	Multip.	0
Lahm[61]	1924	Dresden	3	Yes	?	?	?
Frey[49]	1924	Aarau	5 to 6	0	29	Primip.	0
Sarry and Bogdan[68]	1925	Roumania	3	0	27	Multip.	0
Brouha[43]	1927	Liége	5	0	49	Multip.	?
Wigger[74]	1928	Königsberg	5	?	29	Multip.	0
García[50]	1929	Chile	?	0	?	Multip.	0
Pascale[31]	1934	Benevento	4	0	34	Multip.	0
Jiménez[57]	1935	Spain	4	0	27	?	?
de Snoo[71]	1937	Rotterdam	?	?	16	Primip.	0
Own case	1946	Jersey City	4 to 5	0	30	Multip.	1 mole

Analysis of 57 Cases of Hydatidiform Mole

From the opening of The Margaret Hague Maternity Hospital, Oct. 16, 1931, until Dec. 31, 1944, there have been 75,238 deliveries and 57 cases of hydatidiform mole. This gives an incidence of 0.07 per cent, or one in 1,321. The usual incidence is considered to be somewhat lower—about 1 to 2,000. Our incidence in private patients was 1.7 times that in the ward cases. The distribution by age and parity roughly paralleled the distribution of deliveries by age and parity. Five of the moles occurred in primigravidas of less than 20 years of age, and 25 were seen in primigravidas older than 20 years. Of the 27 multigravidas, 26 per cent had had previous abortions (none of these knew of having had an earlier mole).

In 12 cases (21 per cent) the diagnosis of hydatidiform mole was suggested before the extrusion or removal of vesicles. Cystic ovaries were diagnosed in four cases. A fetus was present in four cases: two of these were twin preg-

nancies, and the other two were true abortions with molar degeneration of the placenta. There were no maternal deaths.

Signs and Symptoms.—1. Bleeding occurred in 96.6 per cent—all but two cases.

2. Secondary anemia, as manifested by red blood cell counts of less than 4,000,000, was observed in 19 patients. Blood transfusions were given in 14 cases.

3. The uterus was larger than to be expected from the period of amenorrhea in 33.3 per cent of cases. It was almost as frequently too small, and sometimes of the expected size.

4. Pre-eclampsia occurred in eight cases, and eclampsia in one, giving a toxemia incidence of 15.8 per cent. By pre-eclampsia, we mean blood pressure greater than 140/90 *and* proteinuria. Marked proteinuria (3 and 4 plus) occurred in another three patients whose blood pressures were less than 140/90.

5. Weight loss was noted in six cases. It probably occurred in others, but only a few charts carried any notation of the weight changes.

6. Friedman tests were done before evacuation of the uterus in only 11 instances. All were positive. Of these, three were done only with the usual quantity of undiluted urine. The other eight were done in dilution, and all were positive with less than 0.1 ml. of urine. The highest dilution giving a positive reaction was 1 to 9,000, while the same urine diluted 1 to 10,000 was negative. Usually the liminal concentration of gonadotropic hormone was not determined.

Toxemia in Molar Pregnancy.—The association of pre-eclampsia with hydatidiform mole is so frequent and so well known that Hitschmann,[76] in his monograph on mole, included early pre-eclampsia as one of the diagnostic criteria. The incidence of toxemia has been variously set at from less than 10 to more than 40 per cent. Hitschmann's review indicates about 30 per cent as a fair average.

Page[77] divided his cases into two groups, which he called "early stage" and "late stage." In 16 patients of less than four months' amenorrhea, or with the tumor below the level of the umbilicus, none had toxemia. In 14 patients with more than four months' amenorrhea, or with the tumor above the level of the umbilicus, 10, or 71 per cent, had toxemia. In our series, 25 patients are classifiable as "early stage"; none of these had toxemia, although two had proteinuria without hypertension. In the 32 patients in the "late stage," there occurred nine cases of toxemia and 1 case of proteinuria without hypertension.

As for the degree of toxemia, eclampsia occurred in one patient; the same patient had severe pre-eclampsia with her first mole (case report). The other seven toxemias were classifiable as "mild pre-eclampsia" by the criteria of the American Committee on Maternal Welfare (ignoring the time of onset).

Labor and Delivery.—Labor was of spontaneous onset in 33 patients (58 per cent); it was induced by bag or bougie in five, and there was no labor in 19 (33 per cent). Delivery of the mole was spontaneous in 34 cases (60 per cent), 21 of whom had a curettage after extrusion of the mole. In 13, the mole was removed by curettage alone. Four moles were removed manually, four by abdominal hysterotomy, one by abdominal hysterectomy, and one by sponge stick.

Puerperium.—1. Febrile morbidity. Six cases, or 10½ per cent, had febrile morbidity. Of the 19 patients having no labor, none was morbid. Five of the 33 having spontaneous labor were morbid, as was one of the cases induced by bag (case report). All six of the febrile patients were delivered spontaneously, four of them having had a subsequent curettage.

2. Persistence of positive Friedman test. After delivery of the mole, the Friedman test, in about half of the series, became negative as follows: five in the first week, four in the second week, nine in the third week (one of these dedeveloped chorionepithelioma—case report), five in the fourth week, three in the fifth week, and three between the sixth and ninth weeks.

Of the tests remaining positive post partum, two occurred in patients with chorionepithelioma. The test was persistently positive for months in two other cases. One of these went to a private physician after two months, and we did not see her again for twelve years. In the other case, the Friedman test was positive in urine diluted 1 to 50 as late as four months post partum; at five months it was weakly positive in undiluted urine, and became negative seven and one-half months after the mole had been removed at hysterotomy. Hamburger,[78] in a follow-up study of 72 cases of hydatidiform mole, found that 9 per cent were still excreting gonadotropin three months after evacuation of the uterus. All tests were negative at six months post partum.

Chorionepithelioma.—Three patients had chorionepithelioma. These are the only cases which have been seen in our service, and all followed hydatidiform mole. All were hysterectomized and all survived. One of the three had a misleading Friedman test (case report). This patient died accidentally about ten months after hysterectomy. The other two patients are alive and well at nine and one-half and eleven years after operation.

Follow-Up

Every patient was followed up for at least one year, and the average length of follow-up is over six years. Three patients have died. One death was accidental (case report), one of myocardial failure seven and one-half years post partum, and the third was an eclamptic death, occurring in the next pregnancy (in another hospital), two and one-half years after the mole. Of the 53 surviving women, all but two have been interviewed during 1945.

The only untoward postmolar incident occurred in a private patient who did not return to her physician after discharge from the hospital. About five months after discharge, she had a severe hemorrhage and passed a hydatidiform mole the size of a football. She was curetted in another hospital, and referred to Dr. Schumann, in Philadelphia. At hysterotomy, he found no molar remnants. In our hands, she had had a second curettage when bleeding persisted after the initial operation. At follow-up, seven years later, she stated that she had had a normal menstrual period after leaving the hospital. Possibly she had a second molar pregnancy.

Subsequent Pregnancies.—Thirty-nine of the patients have had 66 (or 67?) pregnancies subsequent to their moles. One patient had a second mole (case report), and another, just alluded to, may have had. There was one tubal pregnancy, and there were six spontaneous abortions. In the case of the fatal eclampsia, mentioned above, the baby was stillborn. Thus, in 66 pregnancies 57, or 87 per cent, eventuated in live births.

Of the nine cases with mole and toxemia, two did not become pregnant again. There were 13 later pregnancies in the other seven. Three of these seven had four toxemias, one of which was fatal eclampsia, and another a severe eclampsia (case report).

Menstrual Data.—Two patients were hysterectomized at the time of the mole, and three others shortly thereafter, because of chorionepithelioma. Later hysterectomy was done for fibroids in two more patients.

We could find no characteristic disturbances in the menstrual histories, either before or after the molar pregnancies. In one patient, a previously normal cycle was completely suppressed for three years following the mole, but spon-

taneously reverted to normal at the end of that time. Only one patient gave a history of menstrual irregularity, and that antedated the mole. Seven patients think that their periods are shorter or scantier than before the mole, and six think the reverse. All of the rest have noted no deviation from normal, and no change since their moles.

Summary

A case is reported in which the first pregnancy gave rise to a hydatidiform mole accompanied by severe toxemia. This was followed by three normal pregnancies with no sign of toxemia, although anomalous placentation occurred in two. The fifth pregnancy was again a hydatidiform mole, accompanied by eclampsia, and followed by chorionepithelioma. The Friedman tests were misleading in this case.

A review of the literature had revealed descriptions of about 40 cases of recurrent hydatidiform mole. Only five of these women had normal pregnancies occurring between moles.

We have found 35 cases of probable or alleged eclampsia in conjunction with hydatidiform mole.

In over 75,000 deliveries at The Margaret Hague Maternity Hospital, there have been 57 cases of hydatidiform mole (through 1944), giving an incidence of 1 to 1,321.

Three of these moles were followed by chorionepithelioma.

There were no maternal deaths.

The 57 cases of hydatidiform mole are briefly analyzed.

All patients have been followed up for at least a year.

There have been 66 pregnancies subsequent to these moles, with 87 per cent eventuating in live births.

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EXTRAUTERINE PREGNANCY

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THIS study represents an analysis of 90 cases of extrauterine pregnancy, an incidence of 1.5 per cent of the total gynecologic admissions. The incidence recorded here is comparable to that recorded in studies by Graffagimino[1] and by Falk.[2] A survey of the literature of extrauterine pregnancy reveals that the majority of the published data was obtained from charity hospitals. This analysis differs from previous studies principally in two respects. First, that the cases presented were as a rule under observation by their family physicians for varying periods of time before admission, and therefore usually entered the hospital before becoming an emergency. Second, this study may more accurately reflect the usual diagnostic problems, the errors, and the expected clinical course than that of the aforementioned reports, since these cases are those of a moderate-sized voluntary hospital and were cared for by a relatively large number of physicians.

Analysis of Material

Age.—Ages ranged from 19 to 43 years, the average being 30 years. Fifty-one cases (57 per cent) were between 25 and 34 years. These data correspond closely to those of Lisa[3] and Schumann.[4]

Race.—One patient was Negro, and the remaining 89 patients were white. In this hospital the ratio of Negro to white admissions is about 1 to 20.

Parity.—The incidence in relation to parity reveals that the largest group, 29 cases (32 per cent), occurred in patients with no previous pregnancies; 21 cases (22 per cent) with a history of one pregnancy; 16 cases (17 per cent) with two former pregnancies; eight cases (9 per cent) were pregnant three times; nine cases (10 per cent) gave history of more than four pregnancies; and in seven cases (8 per cent), the history of previous pregnancies was not recorded.

Surgical History.—A history of previous abdominal operation was present in 19 patients (20 per cent); six cases (6.6 per cent) had had previous ectopic pregnancy. One patient had had a previous tubal pregnancy four months prior to her second admission. (Smith[5] reported an incidence of 3.6 per cent second ectopic, and Weil[6] reported a figure of 1 per cent).

Pain.—The one constant symptom was pain, which was present in all of the 90 cases.* The character of pain varied according to the pathologic findings. In the cases of ruptured tubal pregnancy, the pain was usually sharp or stabbing. The tubal abortions were usually accompanied by sharp, intermittent pain, while the unruptured tubal pregnancies were usually associated with dull ache. Table I shows that the classical history of stabbing pain and fainting was recorded in only 13 cases (14 per cent). Two cases complained of sudden pain on defecation.

Menstrual Disturbance.—Menstrual disturbance was one of the most common complaints, occurring in 84 cases (94 per cent). The disturbance was usually a period of amenorrhea followed by vaginal bleeding. Forty-one patients

*In this series of patients, four presented more than one type of pain.

TABLE I. PAIN

TYPE OF PAIN	NUMBER OF PATIENTS	PER CENT
Sharp, intermittent	43	46.00
Intermittent cramps	26	28.00
Stabbing pain with fainting	13	14.00
Pain in the shoulder	10	11.00
Dull ache	9	10.00
Labor pain	1	1.00
Sudden pain on defecation	2	2.00

(45 per cent) denied any amenorrhea, but upon careful analysis of the history of these patients, it was noted that frequently the menses had been scant or irregular. Sixty-four cases (71 per cent) complained of scanty bleeding; 10 cases (11 per cent) had continuous slight bleeding; three cases (4 per cent) had profuse bleeding; 13 patients (14 per cent) denied vaginal bleeding.

Gastrointestinal Disturbance.—Symptoms of gastrointestinal disturbance, which were present in 36 cases (40 per cent), consisted mainly of nausea and vomiting, for the major part induced by the abdominal pain. Diarrhea was noted in two cases (2.20 per cent).

Abdominal Examination.—Abdominal tenderness on palpation was noted in 74 cases (82 per cent); abdominal distention was recorded in five cases (8 per cent); rigidity and rebound tenderness was noted in 15 cases (16 per cent).

Pelvic Examination.—Pelvic examination was recorded in only 64 cases (71 per cent). Pain on motion of the cervix was present in 58 cases (90 per cent); adnexal mass was noted in 35 cases (55 per cent); a boggy mass in the post cul-de-sac was noted in 32 cases (50 per cent).

Hematology.—The leucocyte count was performed in 82 cases (90 per cent) on admission. Twenty-eight cases (34 per cent) had a leucocyte count of 15,000 or over. The highest leucocyte count recorded was 36,000. Those patients with active intraperitoneal hemorrhage usually had a high leucocyte count. Erythrocyte count was performed in 80 cases (88 per cent) on admission. Forty-six cases (58 per cent) had an erythrocyte count below 3.5 million on admission. The hemoglobin averaged 65 per cent in 80 cases.

Friedman Test and Sedimentation Rate.—Friedman tests were performed in eight cases. Seven were positive and one was negative. In the latter, clinical evidence indicated that we were dealing with an old ectopic pregnancy. Sedimentation rate was carried out in seven cases. Three patients with active intraperitoneal hemorrhage had a sedimentation rate over 50 mm. per hour.

Hemoperitoneum.—Free blood in the peritoneal cavity was present in 68 cases (75 per cent). The amount of blood present in the peritoneal cavity was not recorded in the majority of the cases.

Type and Location of the Extrauterine Pregnancy.—All of the extrauterine pregnancies were of the tubal variety except one, which was an abdominal gestation of six months' duration, the placenta of which was attached to the mesocolon. Fifty-five cases (61 per cent) of the tubal pregnancies were located in the right tube; 34 cases (39 per cent) in the left tube.

Anatomic Findings.—Table II shows that 60 cases (65 per cent) of the tubal pregnancies were located in the ampulla; 15 cases (17 per cent), isthmic; 1 case (1 per cent), interstitial; 13 cases (15 per cent), location not recorded. These figures are comparable to those reported by Langman.[7] In this series 51 cases (56 per cent) had ruptured tubal pregnancies.

Surgical Procedure.—Table III shows the various surgical procedures carried out in this series.

TABLE II. LOCATION OF RUPTURED AND UNRUPTURED TUBAL PREGNANCY

LOCATION	NUMBER OF PATIENTS	PER CENT
Ampulla—abortion	25	27.00
Ampulla—ruptured	22	24.40
Ampulla—not ruptured	13	14.40
Isthmus—ruptured	15	17.00
Ruptured location not recorded	13	14.40
Interstitial—ruptured	1	1.00

TABLE III. STRUCTURES REMOVED AT OPERATION

STRUCTURES REMOVED	NUMBER OF PATIENTS
Unilateral salpingectomy	57
Bilateral salpingectomy	6
Salpingo-oophorectomy	8
Salpingectomy and appendectomy	7
Salpingo-oophorectomy and appendectomy	4
Bilateral oophorectomy and salpingectomy	2
Salpingectomy and curettage	3
Bilateral salpingectomy and hysterectomy	1
Salpingectomy, myomectomy, and plastic repairs of the tube	1

Transfusion.—Transfusion was done in 36 cases (40 per cent), eight times preoperatively, and the remainder during or after the operation. All of the patients received whole blood.

Preoperative Diagnosis.—Preoperative diagnosis was correct in 66 cases (73 per cent). This figure of correct diagnoses is in keeping with those reported by Schauffler[8] and Johnson.[9] This figure does not include conditions diagnosed as extrauterine pregnancy, which later proved to be incorrectly diagnosed. Incorrect diagnosis, under which extrauterine pregnancy was found at operation, included eight cases of ovarian cyst; seven cases of appendicitis; six cases of pelvic inflammatory disease; two cases of leiomyoma; and one incarcerated uterus.

Mortality.—In this series two deaths occurred, a mortality rate of 2.2 per cent. One patient with a right ruptured interstitial pregnancy was in shock on admission, and expired five hours after admission or one hour following surgery. Unfortunately she was not transfused. The other patient expired ten hours after admission. Her condition was satisfactory both before and immediately following surgery. An autopsy was not granted and we were unable to explain the cause of death.

Discussion

In this survey as already noted, the cases presented were usually under observation by their family physicians prior to admission to the hospital; hence their clinical condition was better than those cases seen in charity hospitals. Only eight cases (9 per cent) were in shock on admission. Ware[10] reported in his series that 20 patients (22.2 per cent) were in shock on admission, and 11 cases (12 per cent) had an erythrocyte count below two million. In this study only a single patient (1.2 per cent) had an erythrocyte count below two million.

The physicians handling the cases reported here preferred conservative measures with their private patients. In this series of cases unilateral salpingectomy was performed in 82 cases (92 per cent), appendectomy in 11 cases

(12 per cent), and hysterectomy in only one case (1.2 per cent). Johnson,[9] however, reported in his series that unilateral salpingectomy was performed in 89 cases (77 per cent), appendectomy in 34 cases (29 per cent), and hysterectomy in 11 cases (9 per cent).

It is interesting to note that diagnostic colopotomy was not used in this series. It is well known that this procedure is of value only in the presence of hemoperitoneum, and often a long, stormy convalescence follows, and this may be the reason why the family physician is reluctant in performing a diagnostic colopotomy.

It is noteworthy that the mortality rate (2.2 per cent) reported here is considerably less than that reported by Ware[10] (5.41 per cent), and that of Lisa[3] (4.3 per cent), whose reports represent the findings of charity hospitals.

The lower mortality rate of a voluntary hospital may be due to several factors. Namely, the patients are admitted in better clinical conditions, and the family physician employs more conservative measures.

Summary

1. Ninety cases of extrauterine pregnancy have been encountered in a voluntary hospital with a mortality rate of 2.2 per cent, from Oct. 1, 1939, to Oct. 1, 1945.

2. Symptoms of pain and some menstrual disturbance, usually amenorrhea followed by vaginal bleeding, were present in almost every case.

3. Abdominal pelvic examination gave valuable information.

4. In this series there were 89 tubal pregnancies and one abdominal pregnancy. The site of the tubal implantation was present most frequently in the ampullary portion, and least frequently in the interstitial.

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529 Osborn Building

SPONTANEOUS RUPTURE OF THE LIVER IN ECLAMPSIA WITH FATAL HEMOPERITONEUM

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SPONTANEOUS rupture of the liver is a rare lesion. Its occurrence in connection with pregnancy has been reported in only a few isolated cases. We present the clinical and postmortem findings in an eclamptic patient with spontaneous rupture of the liver and massive hemorrhage into the peritoneal cavity following induced labor and delivery.

Clinical History.—A 26-year-old Negro woman, para iii, gravida iv, was admitted to the Edward J. Meyer Memorial Hospital Dec. 25, 1944, with convulsions. She died Dec. 27, 1944.

The date of the last menstrual period could not be ascertained. The expected date of delivery was some time in February, 1945. Prenatal care had consisted of one visit to a physician in October, 1944.

For two and a half hours before entry to the hospital, the patient had four convulsions, each of five minutes' duration. Other complaints included blurring of vision with spots before the eyes, and swelling of the ankles.

On examination, the patient was a well-developed and obese Negro woman, acutely ill. The blood pressure was 200/145. The uterus was enlarged to the size of a seven months' pregnancy. No fetal heart sounds were heard. There was dullness in both flanks. The ankles showed 4 plus edema. On rectal examination, no presenting parts were palpated. The cervix was long and firm; it was not dilated.

Laboratory Data.—Urine: specific gravity 1,025; albumin 4 plus; sugar 0; sediment negative. Wassermann test was negative.

Course.—During the first day in the hospital, the patient continued to have convulsions and emesis. She was treated with intravenous glucose and magnesium sulfate, morphine, and a salt-free diet. On Dec. 26, 1944, at 2:15 P.M. the patient was taken to the lying-in room. A sterile bougie was inserted through the cervix. The vagina was packed with sterile gauze. The membranes ruptured toward the end of the procedure. Subsequently, the patient was given intranasal pitocin. Convulsions and emesis stopped. The blood pressure was 205/130.

On Dec. 27, 1944, at 3:05 A.M., the patient had one strong sustained contraction and precipitated the vaginal pack, bougie, and a female infant weighing 2 pounds, 2 ounces from a vertex presentation. The perineum was intact. The secundines* were expressed completely with the baby, who cried and breathed spontaneously.†

Following the precipitate delivery, the patient appeared drowsy. Diarrhea developed. The pulse rate and temperature rose. The blood pressure was 195/145. The uterine fundus was firm.

At 7:00 P.M. the patient rapidly became pale and dyspneic. In a short time the abdomen was distended. A fluid wave was elicited. The blood pressure was

*The placenta and cord weighed 300 Gm. The insertion of the cord was marginal. The placenta measured 13 by 15 cm. in length. It showed no infarcts.

†The infant lived about twenty-four hours. Its weight was 920 Gm.; its length, 34 cm. At autopsy, the findings included prematurity, partial pulmonary atelectasis with aspirated material in alveoli, and petechial hemorrhages in epicardium.

80/70. Treatment for shock was instituted. The patient rallied briefly, but soon the pulse and blood pressure were unobtainable. The clinical impression was "rapid internal hemorrhage;" "possible pulmonary thrombembolism."

Postmortem Examination.—The pathologic diagnosis was status following delivery induced by insertion of bougie in cervix; eclampsia; eclamptic lesions of the liver; subcapsular hemorrhage of anterior and superior surfaces of both hepatic lobes; rupture of capsule of superior surface of left lobe of liver; massive hemoperitoneum with blood clots over left lobe of liver; generalized pallor (anemia); hemorrhage of right rectus muscle; cerebral edema; regressive changes in tubular epithelium of kidney with slight fatty changes in glomerular tufts; slight hypertrophy of left ventricle; hyperemia and edema of lungs; edema of legs and retroperitoneal tissue, corpus luteum of pregnancy in left ovary, lactation hyperplasia of breasts, eosinophilic hyperplasia of anterior lobe of hypophysis, fibrous adhesive pleurisy of left side; cervical cysts; subserous leiomyomas of corpus uteri.

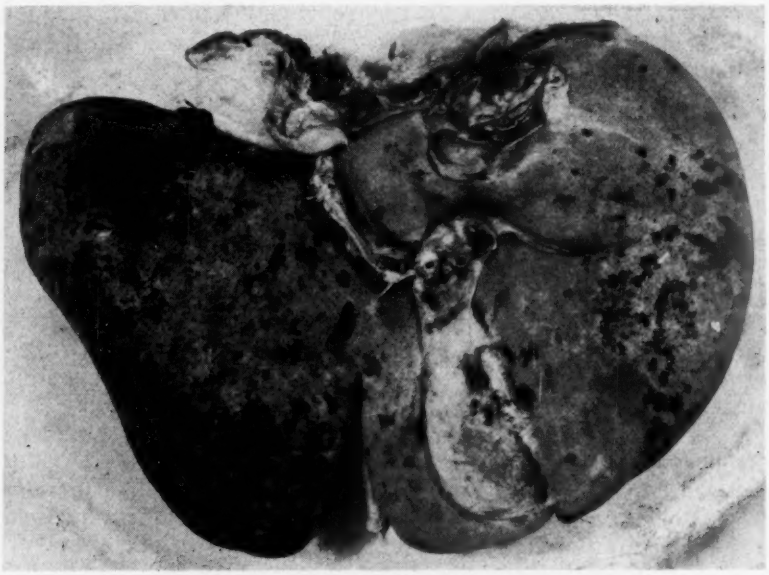

Fig. 1.—Undersurface of liver showing eclamptic hemorrhages.

Description of Liver.—The peritoneal cavity contained a large amount of bloody fluid. The liver projected beyond the costal margin. It weighed 2,800 Gm. The anterior surface of the right lobe showed a subcapsular hemorrhage 19 by 15 centimeters. Its margins were 4 to 7.5 cm. from the superior edge of the lobe; 0.9 to 3 cm. from the lateral edge; and 0.7 to 2 cm. from the inferior edge. The hemorrhage extended to involve the anterior and superior surface of the left lobe. Here the hemorrhagic area measured 17 by 12 centimeters. Its margins were practically flush with the left lateral edge; and 3.1 cm. above the left inferior edge. In the superior surface of the left lobe of the liver the capsule was torn; there was a denuded area 4 by 2.1 cm., over which lay blood clots. The subcapsular hemorrhage measured 2.3 cm. in depth. The remaining surfaces of the liver and its parenchyma was splotched with hemorrhages. The parenchyma was yellow in color. Lobular markings were not clearly seen. Microscopically the liver showed typical eclamptic lesions with recent subcapsular hemorrhage and capsular rupture. Eclamptic lesions were present in relation to the subcapsular hemorrhage.

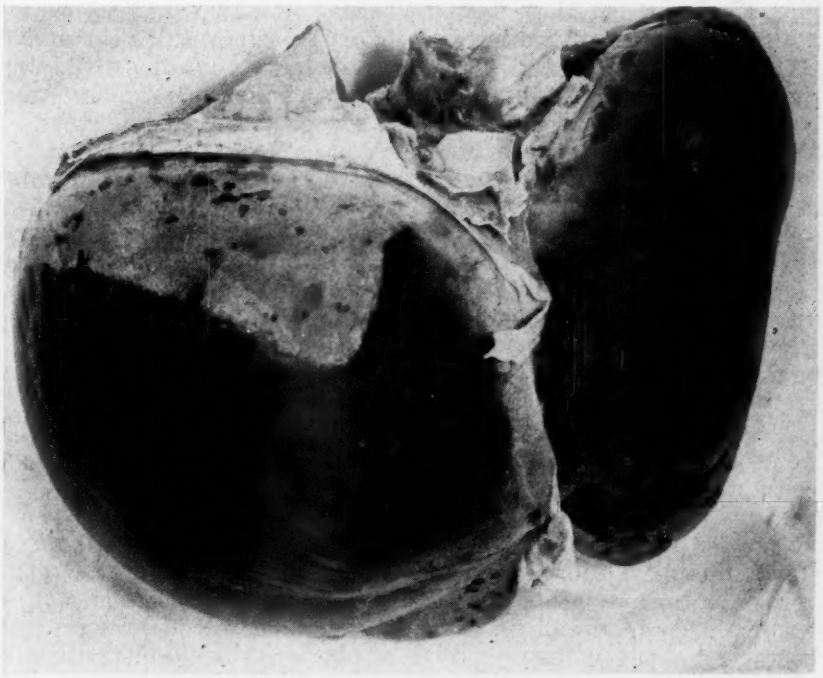

Fig. 2.—Anterior and superior surfaces of liver showing subcapsular hemorrhage.

Fig. 3.—Cross section of liver showing subcapsular hemorrhage.

Discussion

On the basis of the obstetric and postmortem findings, our case was one of eclampsia in the seventh month of pregnancy, with a rare fatal complication. The immediate cause of death was massive hemorrhage into the peritoneal cavity from rupture of the liver associated with subcapsular hemorrhage.

Undoubtedly, the eclamptic lesions in the liver constituted the primary cause for the subcapsular hemorrhage and capsular rupture. Although it is

reasonable to assume that the eclamptic lesions could be the sole cause, other factors which might have precipitated the extensive subcapsular hemorrhage and capsular rupture must be considered. These include convulsions, vomiting, and parturition. In all three, the intra-abdominal pressure rises. There are powerful contractions of the abdominal muscles. In vomiting and parturition, particularly, the diaphragm contracts and descends sharply and deeply. The liver is depressed and compressed. Flexion of the body during emesis and convulsions brings the liver into relation to the rigid costal margin and spine. An enlarged liver with damaged parenchyma is conceived to be less resistant to mechanical effects withstood by a normal organ. Of interest in our case was the limitation of the subcapsular hemorrhage to the anterior and superior surfaces of the liver, despite the fact that eclamptic hemorrhages were abundant beneath the capsule of all surfaces. Might this anterosuperior distribution of the subcapsular hemorrhage suggest the influence of the precipitating factors under discussion, especially in respect to contraction of abdominal muscles and diaphragm, and to rigidity of costal margin, and be related to their effects?

If we accept the premise that convulsions, vomiting, and parturition, could have precipitated subcapsular hemorrhage with capsular rupture in the eclamptic liver of this patient, the question arises whether we can evaluate how much of a part any of these factors played in helping to produce the subcapsular lesion. Certain clinical and pathologic data can be adduced in attempt to form an answer. Up to, and after the time convulsions and emesis stopped, the patient complained of no pain in her abdomen. The blood pressure remained high. It was following delivery with a strong sustained contraction that the patient became drowsy. Then the pulse rate and temperature rose. Diarrhea developed. Sixteen hours later the patient rather rapidly went into collapse and died in a short time, so that the impression of the physician was "rapid internal hemorrhage." Upon the time-relationships of the clinical data, it seems justifiable to speculate that the subcapsular hemorrhage occurred more or less concomitantly with delivery, finally to be complicated by rupture of the capsule over the superior surface of the left lobe of the liver with excessive bleeding into the peritoneal cavity. Microscopic examination of the liver speaks for a recent subcapsular hemorrhage.

Thus far we have assumed the subcapsular hemorrhage and capsular rupture in our case to be spontaneous in origin, because no definite history of significant external trauma to the abdomen was present. In all honesty it should be noted that movements and manipulations to which an ordinary patient is subjected without danger—e.g., transportation from one place to another, palpation, and percussion during physical examination—might possibly prove sufficient to cause subcapsular hemorrhage and rupture of the liver in a patient with an enlarged, tense, damaged organ. The skin and subcutaneous tissue of the abdomen in our case showed no visible effects of trauma. The right rectus muscle revealed a hemorrhage which, on microscopic examination, proved to be a hemorrhagic necrosis associated with regressive and inflammatory changes in the vessels, apparently of eclamptic origin.

From the available literature, we have abstracted five cases of presumably spontaneous rupture of the liver in pregnancy with hemorrhage into the peritoneal cavity.

Kolosoff (1914).[1] A 39-year-old primipara, had severe eclampsia. At the onset of anesthesia for a vaginal cesarean section, the patient collapsed. In the interest of the child, a classical section was carried out. The peritoneal cavity showed extensive hemorrhage. A deeply asphyxiated infant with secundines was extracted from the uterus. The source of the hemorrhage was a necrotic focus on the superior surface of the left lobe of the liver which showed typical eclamptic lesions. The operation was completed on the dead patient.

Herz (1918).[2] A 41-year-old multipara in the eighth month of pregnancy developed severe pain under the right costal margin accompanied by air hunger and emesis. The clinical impression was "gallstone colic." Fetal heart sounds were not heard. The urine showed albumin. When collapse of the patient followed, internal hemorrhage was diagnosed. A postmortem cesarean section was performed. Autopsy disclosed eclampsia with subcapsular hemorrhage on anterior surface of right lobe of liver with a tear near the gall bladder, and with peritoneal hemorrhage.

Duverges (1928).[3] A 39-year-old multipara had eclampsia with convulsions. Suddenly she went into collapse, with pallor and abdominal pain. Fetal heart sounds disappeared. At autopsy there was hemorrhage in the peritoneal cavity and retroperitoneal space, the source of which was subcapsular hemorrhage in an eclamptic liver.

Roemer (1941).[4] A 30-year-old multipara, who had complained of headache for a few weeks, suddenly experienced sharp pain below the right costal arch. The clinical impression was "gall bladder attack." Then the patient had eight convulsions. Fetal heart tones were heard. The patient responded to treatment for eclampsia. Ten minutes after she was moved to another room, the patient went into collapse and died shortly. At autopsy, the chief diagnosis was eclampsia with subcapsular hemorrhage of right lateral surface of liver and with hemorrhage into the peritoneal cavity.

Rademaker (1943).[5*] A 32-year-old toxemic patient with a progressively rising blood pressure was transferred to a hospital in the eighth month of pregnancy when she began to vomit. After admission the patient went into collapse with a dull ache in the right upper quadrant. Labor had not commenced. Fetal heart sounds were absent. The clinical impression was ruptured uterus. At laparotomy extensive peritoneal hemorrhage was found. Following a Porro operation, which yielded a dead immature fetus, the source of the hemorrhage was found to be a tear in the right lobe (apparently anterosuperior surface) of the liver over an area of mushy tissue, about the size of a grapefruit. The torn mushy area was packed. Three months after operation, attended with a stormy convalescence, the patient was healthy; the blood pressure was 145/90.

In summary, all of the five cases of rupture of the liver in pregnancy with hemorrhage into the peritoneal cavity occurred in eclampsia. No patient had a definite history of abdominal trauma. In two cases the clinical picture of rupture and hemorrhage appeared after transportation of the patient. Convulsions were present in three cases. Pain in the right upper quadrant was a common symptom. Shock supervened. Fetal heart sounds disappeared. The anterolateral-superior surfaces of the liver were always involved. In three cases, rupture of the liver occurred from diffuse subcapsular hemorrhage; in two cases, from necrotic foci. Four cases terminated fatally. In one patient operation was carried out with recovery.

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UMBILICAL ACCESSORY LIVER

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HERNIATION of liver into the extraembryonic, celomic cavity of the umbilicus, with or without other portions of the viscera, is extremely rare, and only seven valid cases have been reported in the literature.

In 1903, Sanderson[1] saw a newborn baby twelve hours after birth, apparently suffering from an amniotic hernia. All of the abdominal organs could be seen through the thin, transparent covering which had already begun to dry. Although Sanderson felt that the opportune time for repair of the defect had passed, nevertheless, he advised an operation as a last resort. A marked protrusion already had been produced from the abdominal pressure, and half of the liver had to be resected before it could be replaced in the abdominal cavity in order to bring the muscles and skin together. The baby died twenty-four hours later. Sanderson stressed that the time to operate in such a case is immediately after birth, before the thin, membranous covering of the abdominal wall is dried out, and before the hernial protrusion has increased in size by the accumulation of fluid in the stomach.

In 1905, Stewart[2] reported the case of a well-developed male child with a hernia of the cord the size of a very large apple, which contained the liver and a portion of the intestine. The cord dropped off at the usual time, leaving the sac exposed. A plastic operation was attempted, but the whole of the liver was so adherent to the apex of the sac that its separation was impossible.

Hipsley[3] reported a case in 1925 of a total spherical herniation of the liver into the cord of a male infant. It was reduced surgically twelve hours after birth, and the baby made an uneventful recovery.

In 1941, Sanford[4] reported a case of total herniation of the liver into the cord with the complete recovery of the baby. He stressed the importance of an early operation, allowing twenty-four hours for the baby to recover from the stresses of parturition.

In the same year Searle and Engmire[5] discussed a case of herniation of the entire liver, stomach, gall bladder, and large and small intestines, and mentioned that the only treatment was surgery to be done immediately, as all unoperated patients usually die from peritonitis or paralytic ileus.

In 1944, Casey[6] presented a case of a newborn in which the entire liver was situated in an umbilical sac. The other organs were in their normal location. Surgery was performed four hours after birth with successful results.

The above six cases show herniation of the entire liver; whereas, in the case being presented, separate liver tissue was found in the normal liver location as well as in the extraembryonic celomic cavity near the fetal end of the umbilical cord.

The seventh case reported by Morgagni,[7] and abstracted below, is similar to our case. Upon checking Morgagni's original report, we find that our translation differed from Thomas A. Cullen's making our case the second instead of the original case reported. Our abstract is as follows:

"A paraumbilical tumor, the size of a fist, was seen in a newborn child, born of healthy parents who had other healthy children. The tumor was livid and covered with gangrenous cicatrix. It looked like an umbilical hernia with intestinal contents, including liver. The baby died on the thirty-fifth day after birth.

"A duplicate liver was found in the normal location after dissection of the abdomen. It was smaller than the herniated liver and was connected with it by a thick membrane which contained the portal and hepatic veins and the hepatic artery. The internal liver was divided into several lobes, and the gall bladder was absent."

Morgagni proposed an hypothesis that the duplicated liver could be the result of a twin pregnancy in which only the liver remained, the other parts of the twin fetus having perished in the uterus. Morgagni also quoted a report by Zambeccarius of twins with connected livers and anterior abdominal walls.

Case Report

The case that we are presenting is that of a white baby girl born at the Frank Cuneo Hospital on Dec. 10, 1942, having a congenital malformation of the cord. The baby weighed 2,842 Gm. (6 pounds, 4 ounces). The parents' history revealed no relevant information. The mother had given birth to a healthy boy seven years previously, after a short period of labor.

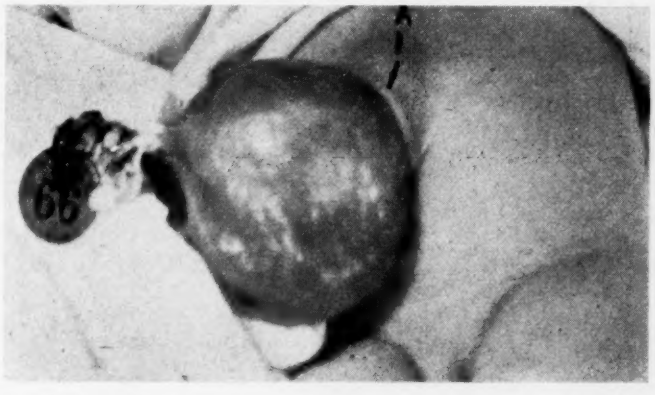

Fig. 1.—View of mass protruding into the umbilical cord.

A large pyriform, yellowish-green mass, breaching the abdominal wall and measuring 7.5 by 7.0 cm. in diameter, protruded just above the umbilical ring. The dilated cord joined the raised skin on the baby's abdomen and was covered with a membrane resembling tissue paper (Fig. 1). The distended portion of the cord was translucent and flatulent, and did not communicate with the peritoneal cavity, except for the passage of blood vessels and possibly a biliary tract.

Blood examination revealed: Hemoglobin, 74 per cent (11.5 Gm.); erythrocytes, 3,500,000; leukocytes, 11,400; coagulation time, three minutes; Rh factor, negative. The baby regurgitated most of its food prior to the operation, which was performed forty-eight hours after delivery under an ethylene anesthesia.

A circular incision was made which extended from the skin through the peritoneum. Grossly, the sac contained a gelatinous substance (Wharton's jelly), a structure which resembled liver substance, and a vesicle containing a mucinous bile. No intestines were found in the sac. There was no connection between the sac and the peritoneal cavity, except the blood vessels which were ligated. A nearly normal-sized liver removed at the autopsy measured 6.5 by 5 by 4 centimeters. Along the lower border of the right lobe of the liver was a fissure 2.5 cm. in length, which extended into the liver for a distance of 6 millimeters. The left lobe was rudimentary, and was separated from the right lobe by an irregular but intact falciform ligament. On the posterior surface the

quadrate lobe appeared to be completely separated from the rudimentary left lobe by the ductus venosus, quite some distance from the caudate lobe. There was no caudate process, so that the lower margin of the caudate lobe was free. A portal vein extended between the right and left lobes on the anterior surface. There were sutures about the left branch of the portal vein and the hepatic artery on the undersurface of the liver in situ. The left branch of the hepatic vein followed the anterior portion of the liver instead of the normal posterior and emptied into the inferior vena cava. The two vessels on the anterior surface, near the falciform ligament, were probably a branch of the portal vein and the hepatic artery. The accessory lobe formed a triangular mass which measured 3 by 2 by 2 centimeters. Extending out to the right of the falciform ligament and to the left of the accessory lobe, which might have been the quadrate lobe, was the gall bladder, 3 cm. in length and twisted upon itself.

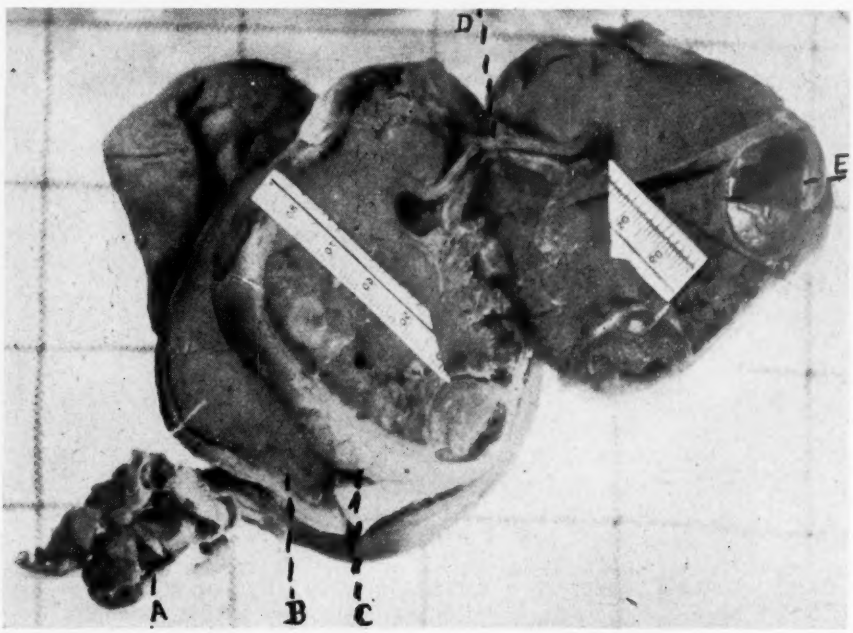

Fig. 2.—Formalin fixed liver sectioned. *A*. Tied off cord. *B*. Receptacle containing bile. *C*. Thick capsule about the liver. *D*. Large vessel entering the liver. *E*. Areas of colloid cystic degeneration.

The right lung weighed 24 Gm. and had four lobes. The left lung weighed 19 grams. Many solid portions were present at the base and posterior portions of the lung. No abnormalities were found in any of the other organs.

The microscopic examination of the mass revealed neonatal liver tissue. The markedly thickened capsule showed an edema and a dense neutrophilic exudation extending into the portal system and separating the liver cords. The hepatocytes were enlarged, granular, and edematous. Degeneration was more extensive near the periphery. There was a marked engorgement of the sinusoids, and comparatively little degeneration of the liver was also found in the usual anatomic location. The abdominal wall was closed in layers.

The baby's immediate postoperative condition was good. Thirty milliliters of the mother's blood was injected into the right buttock about one-half hour after operation. Physiologic salt solution and coramine were given parenterally every half hour after the operation. Oxygen was given continuously. The rectal temperature dropped to 95.4° F. before expiration, twenty-nine hours after surgical intervention.

The gross examination of the hernial sac revealed that the entire mass with its coverings weighed 67.5 grams. It was fluctuant on one side. The external covering resembled tissue paper. The inner covering was thick, rather soft, and gelatinous on one side. The fluctuant portion contained fluid similar to bile. Grossly, the sac had the appearance of a gall bladder, and the fluid within was proved to be bile. The mass, after fixation in formalin, resembled a greenish liver with grey areas of degeneration and a few circular areas filled with homogeneous colloid. The largest cyst measured 11 mm. in diameter. A thickened vessel, filled with blood, entered the liver substance. The sectioned mass revealed a cordlike structure extending into the liver tissue and connected by the umbilical cord on one end, and probably extending to the anterior surface of the liver in situ (Fig. 2).

Harvey[14] was of the opinion that the sac containing bile was large enough to contain all the bile secreted by a neonatal liver.

The postmortem examination showed that the inner peritoneal cut was slightly roughened but completely covered over. The liver extended 2.5 cm. below the costal margin and weighed 52.5 grams. The mass which was removed surgically weighed 67.5 grams. The liver cords stained poorly as compared with those found in situ.

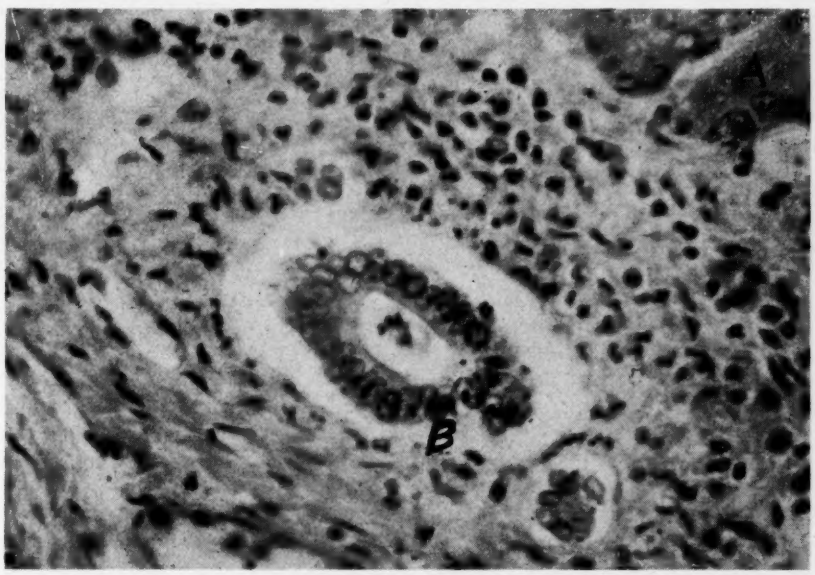

Fig. 3.—Microscopic section of the liver. *A*. Liver cords. *B*. Biliary duct surrounded by fibrous tissue with some inflammatory cells.

Liver buds are evident at three and one-half weeks in the human embryo as they first arise as a diverticulum between the fore- and mid-gut next to the pericardium. The hepatic diverticulum extends into the mesenchyme of the septum transversum between the pericardial cavity and the yolk stalk. The right and left lobes are discernible at six weeks, when the embryo is 12 mm. in length. Normally the intestinal loops are herniated into the umbilical cord between the seventh and tenth weeks of intrauterine life.

Cullen's[8] dictum states that liver cannot survive unless there is a rich blood supply for its existence, namely, arterial and portal, with venous as well as biliary drainage. In this case, the drainage was limited to a sac just outside of the liver, which Harvey maintained was large enough to store all the bile secreted in a neonatal liver.

The etiology of the ectopic liver may be explained that when the vitelline duct retracted into the extraembryonic cavity of the cord during the sixth and seventh weeks, the large and freer left portion of the liver may have become attached to the enveloping mesentery and drawn into that cavity where it developed. The falciform may have been the link of attachment to form the ligamentous trunk. The fact that the vessels entered the anterior rather than the posterior surface would support the view that the trunk was under pressure from a frontal pull, or that cleavage had taken place in order to have the hiatus in front, for these vessels are commonly found on the posterior inferior surface. The biliary remained in situ.

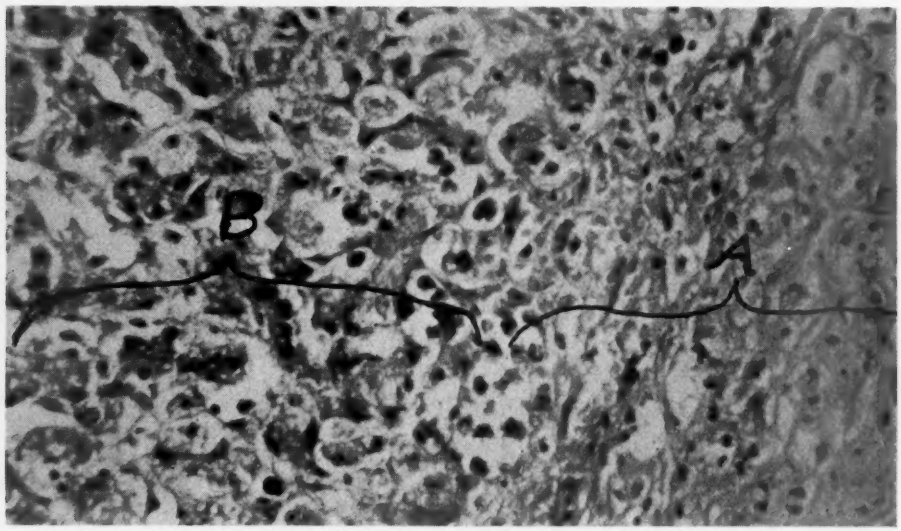

Fig. 4.—Microscopic section of liver found in the umbilical cord. *A*. Thickened capsule. *B*. Reveals the degeneration in the liver cells.

To further support the above theory, it is known that, at the end of the eighth week, the diaphragm is completed and has completed its descent. In the ninth week, when the liver[12] has reached its greatest relative size, the intra-abdominal pressure may have forced the freer portion into the extraembryonic celomic cavity. Additional weight is lent to this hypothesis in our case in that the total liver tissue, even after birth, weighed about two-thirds more than normal. It is, therefore, probable that the liver, having been under abnormal pressure between the ninth and tenth weeks, was forced into the only unclosed avenue of escape, the space in the cord from which the intestines were withdrawn. There is no known mechanism to withdraw the liver as in the rotation of the returning bowel and, consequently, it had to develop in the cord. The pressure of the rectal muscles would offer more resistance than that of the umbilicus, thereby, forcing it to grow out and form a pedicle by pressure of the recti muscles. This agrees with the theory of Morgagni, Sanford, Arey,[11] and Bartlemetz.[13] This theory is further supported by Sanderson's case, in which he had to resect half of the liver in order to effect a closure of the abdomen.

Jacquemet[9] stated that a double liver was never encountered except in double monsters; and, even in subjects when there is a deviation from the normal embryonic development, the liver is invariably present and stable.

Trimingham and his co-workers[10] stated that "the treatment of choice is surgical, and prognosis in the individual case depends largely on how soon after birth, in terms of hours, operation is undertaken."

It is the consensus of opinion that surgical intervention should be undertaken in all of these cases as soon after birth as feasible, calculated in hours rather than days, because of the inflammatory and necrotic changes described above. This school of thought is supported by Sanderson, Sanford, Searle, and Engmire, and Trimingham and his associates.

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SLIDING HERNIA OF THE FALLOPIAN TUBE

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A SLIDING hernia may be defined as a hernia in which a part of the sac wall is made up of a portion of a retroperitoneal viscus. Most commonly, the ascending or descending colon are the organs involved in such a hernia. A. V. Moschowitz stated, "the relative frequency of the organs involved in a sliding hernia is roughly inversely proportional to the amount of peritoneal covering."[1] Based on this idea, he placed the abdominal organs in groups according to their likelihood of entering into the formation of a sliding hernia (Table I).[2] A review, to date, of the reported cases of sliding hernia of the

TABLE I. THE ABDOMINAL ORGANS IN GROUPS ACCORDING TO THEIR LIKELIHOOD OF ENTERING INTO THE FORMATION OF A SLIDING HERNIA*

ALWAYS	NEVER	RARELY	LIKELY
Ureter	Ovary	Sigmoid flexure	Ascending colon
	Stomach	Small intestine	Descending colon
	Liver	Uterus	Broad ligament
	Spleen	Fallopian tube	Bladder
	Transverse colon		Appendix
	Cecum		
	Omentum		

*Table reprinted by kind permission of J. B. Lippincott Co. from article, "Hernia of the Large Intestine with special reference to Sliding Hernia." Moschcowitz, A. V.: Ann. Surg. 37: 611, 1914.

various abdominal organs with reference to their relative frequency of occurrence bears out the soundness of the theoretical basis of this grouping. Only one case of sliding hernia of the Fallopian tube has been reported. That case was described in 1920 by McNealy,[3] and is strikingly similar to the case herein to be reported.

Case History

Mrs. E. S., a widow, aged 41 years, entered the hospital on July 7, 1941, with the complaint of a "lump" in the left inguinal region of eight years' duration. The mass was painless until two years before, at which time an increase in its size was noted and a dragging sensation was felt when lying down, more pronounced when the patient lay on her right side. There was no recollection of the mass reducing itself, nor was reduction attempted. The past history was essentially normal, except for the excision of a benign breast tumor three years before. The menses were regular every twenty-eight days, with a scant flow of two to three days' duration. General physical examination was unimportant, except for the finding of a mass approximately 2½ by 1½ inches in diameter in the left labium, which gave an impulse on coughing. The mass was not easily reducible, and did not transilluminate. Vaginal examination revealed a normal-sized uterus pulled over to the left side.

Operation.—Under gas-oxygen-ether anesthesia, a left inguinal incision parallel to Poupart's ligament was made. The inguinal canal was exposed after splitting the external oblique fascia. The round ligament was isolated. There was a lipoma on its lateral side. A hernial sac was closely adherent and

posterior to the round ligament. The hernial sac in its distal portion was bilocular. One component was medial to and the other lateral to the round ligament. The two locules joined together in a common body and neck. On opening the sac, a tubular mass presented on the posterior wall. This was identified as the Fallopian tube when the fimbriae and a cystic hemorrhagic ovary presented at the neck of the sac. Under the impression that the tube was adherent, an effort was made to free it from the posterior wall of the hernial sac. This procedure gave rise to brisk bleeding, which was controlled by packing. In the face of these unusual findings it seemed expedient to expose the pelvis. The opening in the peritoneum at the internal ring was then extended upward after splitting the transversalis fascia, the transversus, and internal oblique muscles.

On exposure of the pelvis, it was noted that the fundus of the uterus lay close to the left lateral pelvic wall, and that the left broad ligament was missing. The uterine end of the left Fallopian tube was the only portion of the broad ligament within the pelvic cavity. The rest of the tube appeared to enter the internal ring on the posterior wall of the hernial sac. The cystic hemorrhagic ovary and fimbriated end of the tube were within the lumen of the internal ring.

The Fallopian tube was transected at its uterine end. The left ovary was removed after clamping, cutting, and ligating the mesovarium. The Fallopian tube and its fimbriated end were removed with the transection of the sac at the site of the internal ring. The internal ring and the peritoneum incised above it were closed with interrupted silk sutures. The severed transversus and internal oblique muscles were then sutured. A typical Bassini repair followed. Silk sutures were used throughout. The convalescence was uneventful.

Discussion

The formation of a sliding hernia of the Fallopian tube is not difficult to appreciate when the anatomy of the pelvic inguinal region is reviewed.[4, 5]

The broad ligament is covered on its anterior, posterior, and superior surfaces by peritoneum. Medially the peritoneum on these surfaces spreads out to be continuous with the peritoneum covering the uterus. These layers are spread out on the lateral pelvic wall to become continuous with the parietal peritoneum covering the iliac vessels. Inferiorly the layers diverge to form the peritoneal surfaces of the anterior and posterior cul-de-sacs.

The Fallopian tube, except for its lateral fifth, is a retroperitoneal viscus lying in the superior border of the broad ligament. It is completely covered by peritoneum on its anterior, posterior, and superior surfaces. Its inferior surface is connected with the retroperitoneal space in the broad ligament.

The lateral fifth of the uterine tube, known as the infundibulum (fimbriated end), does not truly lie between the layers of the broad ligament. It may be considered to sprout out from the lateral end of the superior border of the broad ligament, completely investing itself with peritoneum. The ovary, in similar fashion, is completely invested by peritoneum and connected to the broad ligament by a pedicle derived from the posterior surface of the broad ligament, and known as the mesovarium. The superior portion of the lateral fifth of the broad ligament that extends from the lateral end of the ampulla of the tube and mesovarium to spread out on the lateral pelvic wall is known as the infundibulopelvic ligament. As the anterior layer of peritoneum of this liga-

ment unfolds to become the parietal peritoneum over the lateral pelvic wall it covers the site of the internal ring. The ovary and infundibulum (fimbriated end) overlie the region of the internal ring.

When a hernia develops at the internal ring, the parietal peritoneum that enters into the formation of its posterior wall is not only in direct continuity with the anterior peritoneal layer of the broad ligament, but also immediately adjacent to it (Fig. 1). If now it is assumed in this case, as it is in sliding hernias of the large intestine, that a very loose connection exists between the peritoneal layers of the broad ligament, the pulling mechanism of the hernia

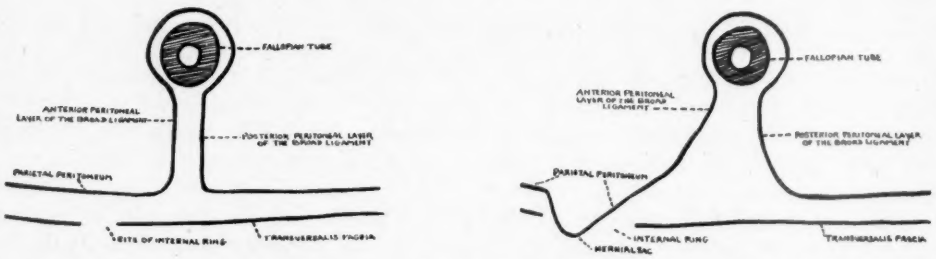

Fig. 1.—First stage in development of sliding hernia of the Fallopian tube. Paramedian sagittal section of pelvic inguinal region viewed from the left side showing the proximity of the internal ring to the broad ligament.

Fig. 2.—Second stage in the development of sliding hernia of the Fallopian tube. The leaves of the broad ligament are being separated and the connection of the anterior peritoneal layer of the broad ligament to the posterior wall of the hernial sac is shown.

Fig. 3.—Third stage in the development of sliding hernia of the Fallopian tube. The inferior portion of the anterior peritoneal layer of the broad ligament is now at the internal ring and makes up the uppermost portion of the posterior sac wall.

Fig. 4.—Fourth stage in the development of sliding hernia of the Fallopian tube. The leaves of the broad ligament have been completely separated. The anterior peritoneal layer of the broad ligament is entirely on the posterior wall of the hernial sac. The enclosed tube is at the uppermost portion of the posterior sac wall at the site of the internal ring.

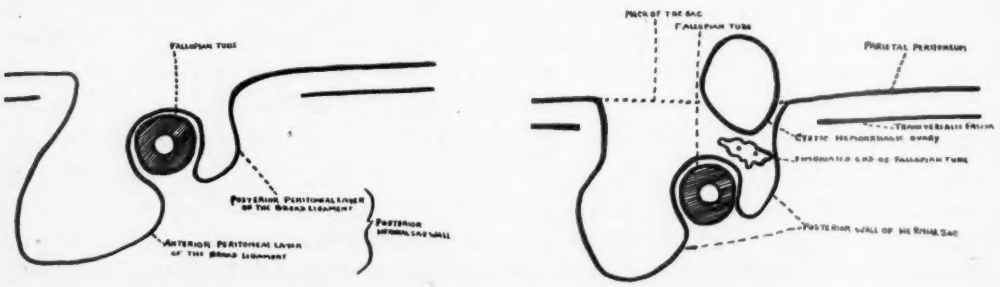

Fig. 5.—Final stage in the development of sliding hernia of the Fallopian tube. The anterior and posterior peritoneal layers of the broad ligament with the enclosed tube have become part of the posterior wall of the hernial sac.

Fig. 6.—Sagittal section of sac and contents as found at operation. The Fallopian tube is part of the posterior sac wall. The cystic hemorrhagic ovary is within the lumen of the sac at the site of the internal ring. The fimbriated end of the tube is within the lumen of the body of the sac as one of its contents.

will unfold the layers of the broad ligament and draw them into the formation of the posterior wall of the sac. The Fallopian tube enclosed between the layers of the broad ligament will therefore be part of the posterior surface of the hernial sac. The various stages in the formation of the sliding hernia of the fallopian tube are illustrated in the accompanying series of diagrams.

Fig. 2 shows the leaves of the broad ligament being separated by the pulling mechanism of the hernial sac. The direct and immediate connection of the posterior wall of the hernial sac with the parietal peritoneum and anterior peritoneal layer of the broad ligament is illustrated.

In Fig. 3 the parietal peritoneum between the anterior peritoneal layer of the broad ligament and the internal ring has been pulled down to make up part of the posterior wall of the hernial sac. The leaves of the broad ligament are almost completely unfolded and the anterior peritoneal layer is now at the internal inguinal ring and makes up the uppermost portion of the posterior wall of the hernial sac.

Fig. 4 shows the entire anterior peritoneal layer of the broad ligament as part of the posterior surface of the hernial sac. The Fallopian tube is now located at the site of the internal ring.

The final stage in the development of the sliding hernia of the Fallopian tube is illustrated in Fig. 5. The posterior peritoneal layer of the broad ligament now occupies approximately the upper half of the posterior wall of the hernial sac. The enclosed Fallopian tube occupies the midposition of the posterior wall.

Fig. 6 is a sagittal section of the hernial sac as found at operation. It is to be noted that the ovary and fimbriated end of the tube are contents of the sac whereas the ampulla of the Fallopian tube is part of the posterior wall of the hernial sac and constitutes a sliding hernia of this organ.

Comment

Graham has called attention to the unusual amount of fat present about the sac in sliding hernia after the inguinal canal is opened.[6] A moderate-sized lipoma existed in this case.

A bilocular sac frequently occurs in the unusual forms of hernia—most consistently in the relatively rare interstitial hernia.[7] The significance of the bilocular sac in this case is open to conjecture.

In retrospect, the history of dragging pain on lying on the right side plus the fact that the uterus was drawn and apparently fixed to the left side of the patient should have made one consider the possibility of the tube and ovary being involved in the hernial sac.

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Department of Reviews and Abstracts

Selected Abstracts

Cesarean Section

Lopez Monti, Ricardo: Intraperitoneal Sulfonamide Therapy in Cesarean Operations on Contaminated Cases, An. d. Inst. matern. y asist. social, Buenos Aires 5: 170, 1943.

The author reports fifteen contaminated cases which were treated by low cesarean section and intraperitoneal sulfonamide therapy, according to the method of Perez and Echevarria. Great care must be taken to: (1) avoid the introduction of amniotic fluid into the peritoneal cavity, which can be accomplished by making a small opening in the uterus through which the amniotic fluid can readily be aspirated; (2) spread the 4 Gm. of sulfanilamide over the peritoneum, since this serous membrane provides the best absorption as compared with other routes of introduction and permits the highest drug concentration in the local blood vessels surrounding the septic focus; (3) suture the walls in five layers and the aponeurosis with chromic catgut, with the view of early mobilization of the patient without danger of evisceration.

The mortality among the fifteen cases was zero and the morbidity rate was 7½ per cent. Sulfanilamide was used in twelve cases; sulfapyridine in two; and sulfachrysoidine in one (the latter being the only case in which complications occurred). The author concludes that provided the operation is done early, and the indications are followed, the results are such as to justify the statement: "the problem of cesarean operation of the contaminated case has positively been solved." Moreover, this method should be used whenever the delivery through the normal route endangers the life of the mother or child. It diminishes the indication for symphysiotomy. The state of the excretory organs and liver must, however, be investigated because a lesion of these organs is a contraindication to the use of sulfa drugs or suggests reducing their amount. In such cases, supportive treatment should be given with vitamins, liver extract and large doses of salt and sugar solution. The analgesic effect of the sulfonamides has also been demonstrated, owing to which sedatives need not be administered. Deep respiration is advised, and early mobilization prescribed, to obviate the danger of pulmonary congestion and embolism.

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Endocrinology

Perez, Manuel Luis: Hyperthyroidism in Women and in Pregnancy, An. d. Inst. matern. y asist. social, Buenos Aires 5: 9, 1943.

The author states that the reciprocal relationship between the thyroid and gonadal glands in the female has been amply demonstrated both clinically and experimentally. Puberty, for instance, modifies the function of the thyroid gland causing its enlargement during the days preceding menstruation. Aside from this physiologic hypertrophy, it may produce pathologic changes ranging from simple goiter to true thyrotoxicosis. Conversely, pre-existing hyperthyroidism may influence the pubertal period, in delaying the first appearance of menstruation and causing subsequent menstrual irregularities. Cases of thyroprivous metrorrhagia, on the other hand, were described by Kocher. True Basedow disease

frequently causes menstrual abnormalities, amenorrhea, and dysmenorrhea. Hertzler found dysmenorrhea in 26 per cent of cases of toxic goiter. Schmit recorded a high basal metabolic rate in 50 per cent of patients with dysmenorrhea. Meldolesi found menstrual disturbances in 76 per cent of cases of Basedow's disease, of which 25 per cent had amenorrhea; 53 per cent of the patients were at the age of puberty. Among endocrine factors causing sterility in the woman those of thyroid origin occupy a prominent place. Many of these cases are amenable to cure by surgical or medical treatment of the thyroid dysfunction.

Pregnancy imposes new metabolic requirements on the thyroid gland to which the latter responds in 70 to 80 per cent of cases, with hypertrophy and hyperplasia (work-hyperthyroidism) accompanied by increased blood content in iodine, increased iodine excretion through the urine, elevated basal metabolic rate and increased amount of thyroid hormone in the circulation. This functional hyperthyroidism explains the appearance of goiter during pregnancy in predisposed women in goiter-endemic areas and other cases in which a latent goiter becomes manifest during pregnancy. Regarding the relation of the thyroid gland to appearance of toxemia, the opinions are still controversial. According to Colvin and Bartholomew, young pregnant women with a basal metabolism over 10 per cent present little or no elevation of blood cholesterol and are apparently less predisposed to toxemia of pregnancy, while women with basal metabolism under 10 per cent have a hypercholesteremia and are more likely to develop toxemia. The effect of dysthyreosis (hyper- or hypothyroidism) on the course of pregnancy is well known (abortion, premature birth, stillbirth, etc.). When a woman with hyperthyroidism arrives at term, the infant is normal in most cases, except in endemic areas where cases of congenital goiter are more common. The milk secretion is little affected by simple goiter, but may be disturbed in cases of thyrotoxicosis. Contrary to the contention of some, pregnancy does aggravate the course of pre-existing toxic goiter. The menopause produces new alterations in thyroid function, which in some cases may reach the proportions of hyperthyroidism, especially if simple or toxic goiter had been present before.

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Extra-uterine Pregnancy

Delascio, D., and Assali, N. S.: Interstitial Ectopic Pregnancy, An. brasil de ginec. **18:** 238, 1944.

The authors believe that the terms: "interstitial" and "intramural" pregnancy apply to the same pathologic process. Interstitial tubal pregnancy is extremely rare. The authors do not agree with those who claim that tubal endometriosis is the most important factor in the etiology of ectopic nidation of the ovum. Other factors, such as inflammatory processes, diverticula, etc., should be considered. The diagnosis of interstitial pregnancy is difficult. The presence of a hard, painful tumor in one of the uterine horns, its broad base at the uterus adjacent to the fundus, which produces asymmetry in the insertion of the tube as compared to the other side, and of a softer and larger uterus than in other ectopic pregnancies, suggest the possibility of interstitial pregnancy. To be considered in the differential diagnosis are: angular pregnancy; pregnancy in a rudimentary uterine horn; subserous myoma; subserous myoma with topical abortion; tubal isthmic pregnancy; and the Braun-Piskacek sign. The prognosis is serious owing to the marked vascularization of the uterine horn, and hemorrhage is much more profuse in interstitial pregnancy than in other tubal pregnancies.

Two cases of interstitial tubal pregnancies are presented. The first patient had a punctiform perforation on the posterosuperior surface of the left horn, covered with epiploon. The operation consisted of hysterectomy. The second patient had a large perforation of the right horn with irregular borders indicating a virtual "explosion" of the fundus. Because of the extremely poor condition of the patient, only resection of the horn could be performed. Despite blood transfusion, the patient died on the operating table.

J. P. GREENHILL.

de Moraes, A.: Radiologic Aspects of Ectopic Pregnancy, An. brasil de ginec. 9: 343, 1944.

The author employed hysterosalpingography in two cases of ectopic pregnancy for diagnostic purposes. In the first case the x-ray picture clearly showed the ovum in the lumen of the tube. In the second case the picture revealed a uterine malformation and a high dislocated tube, the site of the ectopic pregnancy.

J. P. GREENHILL.

Gynecology

Abad Colomer, L.: New Procedure for the Diagnosis of Ovarian Cyst, Rev. españ. obst. y ginec. 1: 287, 1944.

The author describes the sign discovered by Max Fourestier to differentiate ascites from a cyst.

Paracentesis is performed 3 cm. from the unbilicus in the median line and, after evacuation of 2 c.c. of fluid, 200 c.c. of filtered air are injected through the puncture needle. In the case of a collection in a cystic membrane, the imprisoned air is shown on the film in semilunar form determined by the convexity of the swelling, while in ascites the air bubbles appear under the diaphragm separating it from the liver. The vertical position of the patient is essential in obtaining the picture.

J. P. GREENHILL.

Mazza, Horacio L.: Recurrence of Genital Prolapse, Bol. Soc. de obst. y ginec. de Buenos Aires 23: 543, 1944.

The author reports four cases and, on the basis of previous experience and of the opinions expressed by other authors, draws the following conclusions.

Recurring prolapse is so frequent and sometimes constitutes such a serious disturbance that it deserves the greatest attention. Its cause lies in constitutional factors as well as in defects inherent in the operative process. Its surgical correction is perfectly feasible with the currently known techniques, provided that selective judgment is used which is also indispensable in prolapse in general. Although this is an atypical hernia, it is often necessary to adopt an eclectic criterion combining different procedures to obtain greater efficacy, which puts to the test the technical resources and the improvisation faculties of the surgeon.

J. P. GREENHILL.

Calvo Marcos, Miguel, and Botella Llusia, Jose: Condition of Ovaries in Cases of Uterine Myoma, Rev. españ. obst. y ginec. 1: 1, 1944.

The authors studied 91 cases and found that the gynecologist who claims normal behavior for the ovaries of myomatous patients and those who accept the constant presence of follicular cysts in those ovaries are both wrong. The truth lies in between the two claims.

The ovaries are frequently altered and only a small number of patients show evidence of a normal cycle. The latter occurs with relative frequency in women who develop myomas before the age of 40 years. The commonest type of ovaries is that with persistence of follicles are follicular cysts. This is more frequent in women nearing the menopause than in young women. Consequently, a certain relationship between the ovarian disturbances and the myoma may be accepted, but not an absolute correlation.

J. P. GREENHILL.

Ercole, Ricardo: Urology in Gynecology, Bol. Soc. de obst. y ginec. de Buenos Aires 23: 570, 1944.

The author shows that in genital pathology of women trauma, inflammation, tumors, and even hormonal lesions have a repercussion on the urinary apparatus, sometimes producing lesions that are more serious than the genital lesion itself. In the study of gyne-

cologic disorders, it is necessary to keep in mind the concept of pathology of the system in the anatomic and functional unit of the genitourinary tract. From this point of view, excretory urography is the method which provides the most important information on the condition of the urinary apparatus and should, therefore, be routine in the examination of the female genital tract. In cases in which this examination is insufficient, recourse must be taken to more specialized measures and the collaboration of the urologist should be useful.

J. P. GREENHILL.

Gynecologic Operations

Gaston, Eugene A.: Total Abdominal Hysterectomy and the "Occasional Operator," Surg., Gynec. & Obstet. 80: 539, 1945.

In order to counteract the impression that total abdominal hysterectomy is an operation safe only in the hands of an expert pelvic surgeon, the author presents a series of 65 personally operated cases. He states that in a community of 25,000 persons there was an average of only 18.6 hysterectomies a year. Thus the general surgeon serving such a community could never become more than an occasional operator as far as this operation was concerned. The cases considered were all done for benign conditions and the total operation was performed in all instances unless contraindicated. The technique used was that described by Meigs, and adequate pre- and postoperative care was stressed. Using 35 supracervical hysterectomies as a control series, the author was unable to demonstrate any significant difference in mortality, morbidity, or postoperative changes in sex life. There was a slight increase in minor postoperative complications in the total group.

LT. L. M. HELLMAN, M.C., USNR.

Borras, Pablo E.: Strassmann's Operation in Some Uterine Malformations, Bol. Soc. de obst. y ginec. de Buenos Aires 23: 250, 1944.

The author states that in cases of separated double uteri it is not necessary to perform any surgical repair, while in cases of double uterus with one cervix or bicornuate uterus, repair is advisable. These malformations are usually found during a laparotomy or on the occasion of some complication. The author has always used Strassmann's operation which seems to be the most rational one.

The two uteri are located and the possibilities of repair are studied. The line of incision is traced along the internal border of each hemiuterus. After preliminary circulatory block, the cavity of each hemiuterus is entered along the line of incision, the cervical canal is located, and the internal orifice is adequately dilated. The two cavities are united and their posterior borders, fundus, and anterior borders are sutured. The operation is ended by reinforcing the suture of the walls with a layer of seromuscular peritonization.

J. P. GREENHILL.

Labor: Management, Complications, Etc.

Frid, Isidoro J.: Fifty Cases of Rupture of the Uterus During Pregnancy and Labor, An. d. Inst. matern. y asist. social, Buenos Aires 5: 125, 1943.

Fifty cases of rupture of the uterus during pregnancy and labor are reviewed by the author. The present statistics are based on the material of the Institute of Maternity of the Alvear Hospital from 1912 to 1942. Among the 37,898 cases, including 31,173 deliveries, rupture of the uterus was found in 0.13 per cent of the cases. Hence, in a period of thirty-one years, there occurred 50 uterine ruptures. Eleven (22 per cent) occurred during pregnancy and 39 (78 per cent) occurred during labor. The maternal mortality among the cases which occurred during pregnancy was 45.45 per cent, and the fetal mortality was 81.81 per cent. The causes of the rupture were: scars from previous cesarean operation, two cases;

myomectomy scar, one case; villous penetration, one case; former molar gestation, one case; abdominal trauma, one case. In five cases the etiology could not be established. Among the cases which occurred during labor, the causes of rupture were: internal version (28.2 per cent); transverse presentation (15.3 per cent); forceps (15.3 per cent); scars (12.8 per cent); and fetal gigantism (5.1 per cent). The retention of the aftercoming head, contracted pelvis, Bandl's ring, and face presentation accounted for one case each. In four, no etiology could be found. In three cases the rupture occurred in the corpus (7.6 per cent); and in 36, in the lower uterine segment (92.3 per cent). There were 24 maternal deaths (61.5 per cent); 11 patients succumbed to hemorrhagic shock (28.2 per cent), 10 to generalized peritonitis (25.6 per cent), and one (2.5 per cent) to each of the following causes: endometritis with septicemia, myocarditis, and pelvic peritonitis. Fetal mortality was 76.9 per cent.

The treatment varied: subtotal or total hysterectomy, suture of the scar and expectancy. In recent years maternal mortality has been reduced thanks to the attention given to the general condition of the patient and to the methods to improve it, such as blood or plasma transfusion and administration of analgesic drugs which help the patient to endure the intervention. A still better prognosis is to be expected, at least for the mother, owing to the improved methods of treatment of obstetric and hemorrhagic shock and to the intraperitoneal application of the sulfonamides.

J. P. GREENHILL.

Otero, Francisco de Borja: Episiotomy. Technic to Obtain Anatomical Cicatrization, An. d. Inst. matern. y asist. social, Buenos Aires 5: 185, 1943.

Unlike the old methods which produce unsatisfactory cicatrization because of unequal retraction of the wound margins, the technique described by the author assures symmetrical approximation of the different layers.

Two Michel clamps are inserted on each side of the site of the episiotomy incision. After expulsion of the fetus, the clamps, although displaced together with the margins of the wound, indicate the position of the perineovaginal junction line. A catgut suture is passed through each of the clamps and lateral traction is exerted during the musculoaponeurotic suture, downward traction during the suturing of the vaginal incision and upward traction during suturing of the perineal skin. The technique is so simple that any physician can use it; the placing of the clamps can be done quickly and no anesthesia is necessary.

J. P. GREENHILL.

Morassi, A.: Medical Induction of Labor, Obst. y ginec. latino-am. 2: 867, 1944.

In 1931, Kreis advocated the following routine for women in labor: (1) artificial rupture of the membranes even if the cervix is dilated only 2 cm., and (2) the use of antispasmodics to overcome spasm of the cervix. By these measures, Kreis has been able to shorten considerably the duration of labor. This form of treatment is routinely carried out in Strasbourg. Morassi condemns this routine treatment of labor cases. He agrees with the Argentine School headed by Peralta Ramos who uses these measures only when indicated in cases of dysfunction of uterine activity in prolonged labor. In such cases obstetric and surgical interference is usually necessary in the interests of both the mother and the baby.

J. P. GREENHILL.

Miscellaneous

Copley, Alfred Lewin: Studies on Human Placental Thromboplastin, Science 101: 436, 1945.

In a short note, the author announces the production of high potency thromboplastin from the human placenta. Although the method is not given in this publication, it is stated that the thromboplastin is a protein phospholipid, fully as active as that produced

by Howell from pig lungs. In vitro it causes clotting of hemophiliac blood intravenously in dogs; in small doses it shortens the coagulation time, the period of higher coagulability lasting up to two weeks. Used locally in dog surgery, it caused almost instantaneous coagulation of bleeding surfaces.

LT. L. M. HELLMAN, M.C., USNR.

Rodriguez de Ginocchio, Mercedes: Social Factors in Genital Hypoplasia, An. d. Inst. matern. y asist. social, Buenos Aires 5: 139, 1943.

The author states that aside from endogenous, constitutional factors, external factors play an important role in producing genital hypoplasia. The best known of these is the alimentary factor. The vitamin-hormone relationship, the effect of deficiency diseases on sexual development and function, on sterility, amenorrhea, tendency to abortion and prematurity, have been demonstrated clinically and experimentally. Social factors such as poverty, ignorance, fatigue, dietary regime, etc., are potent causes influencing the development of glands of internal and external secretion. Other important exogenous factors are infections, especially syphilis and tuberculosis because of their effect on the offspring and the changes they produce in the germ plasm. Malaria and ankylostomiasis may cause genital hypoplasia through the anemia they produce. Excessive sports or sedentary life, composition of the water, climate and the soil, are other factors which may influence the incidence of genital hypoplasia. Chronic intoxication, alcoholism, and morphine addiction are well known for their deleterious effect on the germinal elements and development of the ovum. Among the chronic intoxications apt to produce changes in the genital organs are industrial poisoning with arsenic, mercury, phosphorus, and benzol and its derivatives, lead and nicotine. Important factors in the configuration of the soft tissues of the body of the following generations are emigrations and successive racial intercossings. The various opinions of the constitutionalistic schools which aim to perfect the human race are reviewed.

J. P. GREENHILL.

Newborn

Arnheim, Ernest E.: Congenital Ileal Atresia With Gangrene, Perforation, and Peritonitis in a Newborn Infant, Am. J. Dis. Child. 69: 108, 1945.

A case of congenital atresia of the ileum with gangrene, perforation, and peritonitis in a newborn infant is reported. This is the twelfth reported cure of atresia of the intestine below the duodenum and the second cure of a patient in this condition when perforation and peritonitis had supervened.

JAMES P. MARR.

Elizalde, P. I., and Latienda, R. I.: Prenatal Tuberculosis, Arch. Soc. argent. de anat. norm. y pat. 5: 576, 1943.

The authors have collected sixteen cases of prenatal tuberculosis which they consider authentic. In all of these cases, the infant was removed from the mother immediately after birth. Twelve of the cases probably had a hematogenous source, three were due to aspiration, and one had an intrapartum origin. The lungs were involved in all of the sixteen babies. The survival time of the infants varied from 24 to 245 days, with an average of 64 days.

J. P. GREENHILL.

Orengo Diaz del Castillo, F.: Study on the Newborn in Eclampsia, Rev. Españ. obst. y ginec. 1: 85, 1944.

The author found that, of 203 children born in Santa Cristina Maternity Hospital of Madrid of eclamptic mothers, 30.8 per cent were premature. The average weight of the children at term was 3,086 grams. The usual proportion of sexes was changed into 100

females to 151 males. The infant mortality showed a definite relationship with the age of the newborn, and was 52.9 per cent for the premature ones and 25.6 per cent for the children at term. The total mortality was 34.2 per cent.

The number of eclamptic attacks in the mother influenced notably the infant mortality, which was 29.1 per cent for mothers who had one to nine attacks, and 55.5 per cent for those with ten or more attacks.

Treatment by cesarean section gave an infant mortality of 11.4 per cent; by magnesium sulfate, 23.5 per cent; and by the Stroganoff Zweifel technique, 41 per cent. Nevertheless, the treatment with magnesium sulfate and hypertonic glucose solution is the treatment of choice which protects both maternal and fetal interests.

J. P. GREENHILL.

Pregnancy: Complications, Etc.

Bidoire, A.: Acute Salpingitis and Pregnancy, Gynéc. et obst. 40: 519, 1939.

Acute salpingitis rarely complicates pregnancy because the two conditions are usually incompatible. The etiology of the salpingitis is either gonorrhea, puerperal infection or tuberculosis. The tubal involvement may precede the gestation, or it may begin with the onset of pregnancy. In the latter cases, the causative organism is either the gonococcus or the streptococcus. The complications which may arise are acute inflammation, pyosalpinx, and generalized peritonitis. The prognosis is bad. The diagnosis is difficult to make, but it is important because a decision must be made whether to treat the case medically or surgically. In the differential diagnosis the following must be considered: ectopic pregnancy, torsion of an ovarian cyst or suppuration of an ovarian cyst, and acute appendicitis.

Treatment is the same as if the patient were not pregnant. Whenever possible, it is best to wait until the fever subsides before operating. If a pyosalpinx is suspected, however, it must be removed.

J. P. GREENHILL.

Turenne, A.: Treatment of Intact Dead Retained Ovum, Obst. y ginec. latino-am. 3: 9, 1945.

The author advises a policy of expectancy when one diagnoses an intact, dead, retained ovum. Considering the element of uncertainty in such cases, the patients must be carefully examined from time to time, especially in the first six months when a definite diagnosis of fetal death is made. Treatment will depend on the duration of the pregnancy, the local and general condition of the patient, and the menstrual history (to avoid using oxytocics in the presence of genital hypofunction). It must be remembered that in some cases of fetal death during the last three months, there is a great tendency toward uterine atony and serious bleeding. The procedure chosen for emptying the uterus must carry the least risk for the mother, and it should preferably end in spontaneous evacuation of the uterus.

J. P. GREENHILL.

Correspondence

Recurrent Placenta Previa

To the Editor:

Dr. Monrad E. Aaberg reports in the April, 1946, issue of this JOURNAL two cases of recurrent placenta previa and states that a review of the literature reveals only 10 instances of recurrent placenta previa in successive pregnancies. He has overlooked the case reported by us, C. J. Andrews and Richard B. Nicholls, in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY **42**: 538, 1942. Also, the case of J. Binder, in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY **28**: 92, 1934. Our patient had placenta previa in three successive pregnancies.

This information does not change the conclusion of Dr. Aaberg, that recurrent placenta previa is an uncommon obstetric complication, but it is obviously desirable that the record should be as accurate as possible.

C. J. ANDREWS, M.D.
RICHARD B. NICHOLLS, M.D.

NORFOLK, VA.
MAY 24, 1946.

Traveling in Pregnancy

To the Editor:

It has been a time-honored custom to interdict traveling during pregnancy. Yet, the taking of a journey, either long or short, is sometimes necessary under such circumstances because of the economic dependence of the wife on her husband, as well as her desire to be near him. Mary and Joseph made a long noncommodious journey near term without mishap, and when a stillbirth would have affected the destiny of the entire world.

During World War II, travel by pregnant women on land, sea, and in the air, by train, automobile, boat, and plane, took place on an unprecedented scale. Yet general practitioners and obstetricians alike, whether in private practice or in the military service, have not observed any untoward effects; the normal hazards of travel not included.

This vast experience, as well as scattered reports on the subject, has not disclosed any increase in the incidence of miscarriage, premature labor, placenta previa, or toxemia. Moreover, the lowering of the maternal and infantile mortality rates throughout the nation bespeaks the relative innocuity of commodious travel per se.

Yet, physicians are known to refuse permission for their patients to travel, going so far as to refuse to discuss the matter. The doctor who is called upon for prenatal care, knowing that the patient will leave his jurisdiction after several weeks or months can render great service to the patient and to his contemporaries if he would proceed with prenatal care as if he were going to perform the delivery. The payment of prorated fees to cover each visit, laboratory tests, and a complete transcription of the record can be expected of most patients, including those participating in the EMIC program. Much delay and writing back and forth is avoided if the patient carries the record with her.

It may be fitting for the Committee on Maternal and Infant Care to study various prenatal forms now in use and consolidate them into one standard form for use by physicians on a national scale, as a distinct contribution toward improvement of maternal care in general, and also of the many women who will continue to travel during pregnancy.

CARL T. JAVERT, Lt. Colonel, M.C.

A.A.F. STATION HOSPITAL
RIVERSIDE, CALIF.
MAY 2, 1946.

Item

American Board of Obstetrics and Gynecology, Inc.

The annual meeting of the Board was held in Chicago, Illinois, from May 5 to May 11, 1946, at which time one hundred forty-one candidates were certified.

A number of changes in Board regulations and requirements were put into effect. Among these is the requirement that case records must now be forwarded to the Secretary's Office from thirty to sixty days after the candidate has received notice of his eligibility for admission to the examinations for certification. At this meeting the Board also ruled that it will not accept the nine months residency as an academic year toward years of training requirements following the termination of the official period of intern and residency acceleration, April 1, 1946.

The next written examination (Part I) for all candidates will be held in various cities of the United States and Canada on Friday, Feb. 7, 1947, at 2:00 P.M. Candidates in military service are requested to keep the Secretary's Office closely informed of changes in address.

Applications are now being received for the 1947 examinations. Closing dates for these applications will be Nov. 1, 1946.

For further information and application blanks address Paul Titus, M.D., Secretary, 1015 Highland Building, Pittsburgh 6, Pennsylvania.

PAUL TITUS, M.D.